PB-215 944

A STUDY OF INDUSTRIAL WASTE POLLUTION IN THE SOUTH PLATTE RIVER BASIN. APPENDIX B. INDUSTRIAL PLANTS VISITED AND SAMPLED

Federal Water Pollution Control Administration
Denver, Colorado

December 1966

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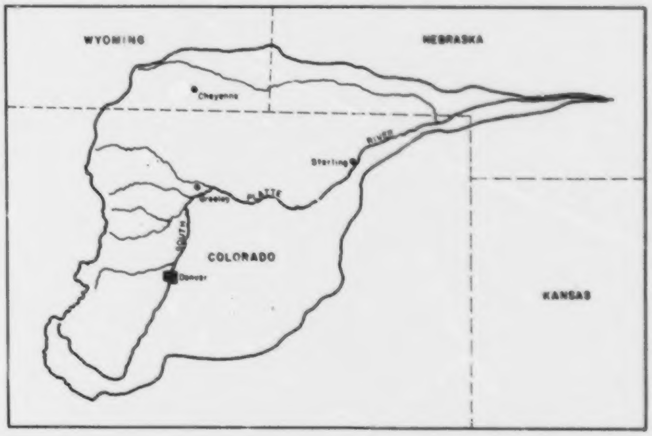
APPENDIX B - INDUSTRIAL PLANTS VISITED AND SAMPLED

Supplement to the Basic Report -

A STUDY OF INDUSTRIAL WASTE POLLUTION IN THE SOUTH PLATTE RIVER BASIN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U.S. DEPARTMENT OF THE INTERIOR
Federal Water Pollution Control Administration
South Platte River Basin Project
Denver, Colorado

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Appendix B - Industrial plants visited and sampled, supplement to the basic report - A study of industrial waste pollution in the South Platte River basin. Denver, Colorado. December 1966. (PR-6B) No LC as of 10/71

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APPENDIX B - INDUSTRIAL PLANTS VISITED AND SAMPLED

Supplement to the Basic Report -

A STUDY OF INDUSTRIAL WASTE POLLUTION IN THE SOUTH PLATTE RIVER BASIN

U.S. DEPARTMENT OF THE INTERIOR
Federal Water Pollution Control Administration
South Platte River Basin Project
Denver, Colorado

DECEMBER 1966

APPENDIX B

A two and one-half year Industrial Waste Survey in the South Platte River Basin was culminated by the Federal Water Pollution Control Administration, South Platte River Basin Project in late 1966. The highlights of this Survey together with major recommendations on pollution abatement by industry are given in the basic report entitled "A Study of Industrial Waste Pollution in the South Platte River Basin." The Appendices shown herein represent a supplementary issue to the main report. However, these Appendices are essential to an understanding of the main survey and the primary document. The reader is encouraged to make full use of the four Appendices which have been prepared as four separate and additional reports and contain a wealth of information on the industrial waste picture existing within the Basin.

Appendix A gives pertinent information on the waste problems of 58 industrial companies. These plants were all visited but no waste sampling was undertaken by personnel of the South Platte River Basin Project. Appendix B presents detailed data on the waste handling and abatement procedures employed by 33 specially-selected industrial companies together with waste sampling results. In Appendices A and B, separate survey reports have been prepared for each of the 91 companies covered by the study. Appendix C provides the location and description of 639 outfalls, pipes and ditches representing potential or real sources of contributory pollution to Basin streams. These outfalls receive industrial wastes from one or more industries which could not be readily identified. Waste sampling was undertaken on 74 of these outfalls and all results are shown. Appendix D contains the results of a special study on the waste disposal problems of the meat industry within the Denver Metropolitan Area.

Appendix B included under this cover and entitled "Industrial Plants Visited and Sampled" is subdivided into two main sections, 27 companies within the Denver Metropolitan Area, and 6 in the Remainder of the Basin. A separate report is given for each of the 33 companies represented with all sampling results. The group covers a wide range of industries including meat and poultry processing, rendering, railroad yards, oil refining, vegetable canning, metal fabricating and assembly, milk processing, missile testing and fabricating, paperboard manufacturing, airport services, power production, brewing, and chemical research and manufacturing. The companies included in this category were those considered most likely to have significant waste discharges to Basin streams and important waste disposal problems. Therefore, the reports shown in this Appendix are generally more detailed than the writeups given in Appendix A. The plants in Appendix B are of much greater interest and concern in terms of causing serious stream pollution.

In most cases, the plant reports contained information on the date of visit, persons contacted, process and operation, sources and uses of water, sources and characteristics of wastes and existing waste problems together with suggested courses of action for coping with these problems. Specific recommendations for waste abatement and treatment are to be found in the main report. Sixty-four tables have been employed showing all the industrial waste sampling data collected for the 33 companies under study. Illustrations and figures have been used wherever necessary to give the reader a better understanding of the company operations, waste disposal pattern, and other pertinent features.

The following list shows the company name, city or county location, and page numbers assigned to the particular writeup as it appears in Appendix B. Complete listings including a full description, the Project Station Number, and the River Mileage for each and every sampling station employed for the industrial plants below, are given in Table LII for the Denver Metropolitan Area, and in Table LXVI for the Remainder of the Basin. Constructive criticism is solicited and essential to the information contained in this report.

DENVER METROPOLITAN AREA

Item	Page
Armour and Company, Denver	B- 4
Capitol Packing Company, Denver	B- 7
Capitol Rendering Company, Adams County	B- 9
Chicago, Burlington and Quincy Railroad, Denver	B-12
Colorado and Southern Railroad, Denver	B-14
Colorado School of Mines Research Foundation, Inc., Golden	B-16
Continental Oil Company, Commerce City	B-18
Adolph Coors Company (Brewery) combined with the City of Golden	B-22
Coors Porcelain Company, Golden	B-27
Denver and Rio Grande Western Railroad, Denver	B-30
Denver Union Stockyard Company, Denver	B-33
E. I. Du Pont de Nemours and Company, Louviers	B-37
Empire Petroleum Company (Conoco Asphalt Company), Commerce City	B-40
Gates Cyclo Poultry Farms, Brighton	B-43
Gates Rubber Company, Denver	B-46
General Chemical Division, Allied Chemical Corporation, Denver	B-52
Kuner Empson Company, Brighton	B-60
Litvak Meat Company (Includes Stovall By-Products), Adams County	B-65
Martin Company (Division of Martin-Marietta Company), Littleton	B-68
Packaging Corporation of America, Denver	B-71
Public Service Company of Colorado (Includes the Arapahoe, Zuni, and Cherokee steam power plants), Denver	B-74

Item Page

Shwayder Brothers, Inc. (Samsonite Corporation), Denver B- 80
Stapleton International Airport, Denver B- 86
Swift and Company, Denver B- 96
Tenneco Oil Company, Commerce City B- 98
United Fryer and Stillman, Inc., Denver B-101
Wilson and Company, Inc., Denver B-103

REMAINDER OF BASIN

Carnation Company, Johnstown, Colorado B-111
Cyclone Filter Division, Gould National Batteries, Inc., Longmont, Colorado B-113
Kuner Empson Company, Longmont, Colorado B-115
Lowell-Paul Dairy, Greeley, Colorado B-122
Monfort Packing Company, Greeley, Colorado B-125
Weld County Bi-Products Company, Greeley, Colorado B-129

DENVER METROPOLITAN AREA

ARMOUR AND COMPANY
4800 Washington Street
Denver, Colorado

Date of Visit: October 5, 1964

Persons Contacted: K. R. Neidholt, General Superintendent
Ken A. Poggi, General Manager

Process and Operation: Armour and Company operates a slaughterhouse together with processing and preparation of various meat products.

Sources and Disposal of Wastes: Blood from the slaughter area is collected and sold to the Meinerz Blood Dehydrating Company of Denver. Edible and inedible tankage is delivered to the Denver Rendering Company. Paunch manure is separated by means of a rotary screen with one-sixteenth-inch openings; these solids are sold to the Ruedy Fertilizer Company of Denver and the paunch manure drainage is released to the City of Denver municipal sewers. The large majority of drainage from the holding pen areas are also received by the municipal sewer system.

Certain plant wastes are discharged to the South Platte River including excess drainage from the animal feed pens, washings of the cattle chute, area runoff collected into storm sewers, spent cooling water from the plant, and drainage off the paunch manure hauling-trucks. Remaining plant wastes are discharged to the Denver sanitary sewers.

APPENDIX B - TABLE I

ARMOUR AND COMPANY
DENVER, COLORADO
SAMPLING RESULTS

Discharge from twin 12-inch outfalls to South Platte River

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/l	TSS mg/l	VSS mg/l	Settl. Sol. ml/l	Oil mg/l	Flow MGD
10/12/64	G	1000	25.0	7.3	380	12	10	<0.1	23	0.29
10/12/64	G	1500	22.0	7.4	270	8	8	<0.1	14	"
10/13/64	G	1030	24.0	7.5	12	7	7	<0.1	29	"
10/13/64	G	1405	25.0	7.2	10	12	9	<0.1	29	"
10/14/64	G	1005	22.0	7.3	28	21	13	0.2	7	"
10/14/64	G	1400	22.0	7.2	52	35	27	<0.1	4	"
10/12/64 to 10/13/64	C	1030 1030	--	7.8	12	9	7	<0.1	--	0.29
10/13/64 to 10/14/64	C	1030 1005	--	7.8	5	6	3	<0.1	--	0.29

APPENDIX B - TABLE II

ARMOUR AND COMPANY
DENVER, COLORADO
SAMPLING RESULTS

Discharge from 10-inch galvanized pipe to South Platte River

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/l	TSS mg/l	VSS mg/l	Settl. Sol. ml/l	Oil mg/l	Flow MGD
10/12/64	G	1000	16.5	8.4	--	8	6	<0.1	5	0.04
10/12/64	G	1500	16.0	9.9	125	669	39	1.2	21	"
10/13/64	G	1040	17.0	8.6	4	6	5	<0.1	11	"
10/13/64	G	1415	17.0	8.4	--	6	4	<0.1	18	"
10/14/64	G	1015	17.0	8.6	--	< 2	< 2	<0.1	< 2	"
10/14/64	G	1400	17.0	10.2	7	120	5	0.4	2	"
10/12/64 to 10/13/64	C	1040 1040	--	9.0	27	50	27	<0.1	--	0.04
10/13/64 to 10/14/64	C	1040 1015	--	8.1	38	47	30	0.3	--	0.04

CAPITOL PACKING COMPANY
5000 Clarkson Street
Denver, Colorado

Date of Visit: October 5, 1964

Persons Contacted: Don Averch, President
Mr. Reinhardt, Chief Engineer

Process and Operation: The Capitol Packing Company conducts both slaughtering and rendering operations.

Sources and Disposal of Wastes: Paunch manure is separately settled in a 6x8x6-foot tank; the solids are hauled away for use on farmers' lands and the paunch manure drainage is released to the City of Denver municipal sewers. The Capitol Packing Company operates its own rendering facilities for blood, meat and bone scraps, and grease. Plant wastes exclusive of paunch manure are passed through a 5x8x5-foot tank for grease removal before discharge to the municipal sewers. Manure from the holding pens is removed for use by local farmers. Drains in the holding pens lead to the sanitary sewers. Plant personnel stated that only spent cooling waters are discharged to the South Platte River by means of an overflow sewer.

APPENDIX B - TABLE III

CAPITOL PACKING COMPANY
DENVER, COLORADO
SAMPLING RESULTS

Discharge from 12-inch outfall to
South Platte River downstream of cattle overpass

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Flow MGD
1/26/65	G	0840	19.0	7.4	4	--	2020	11	7	<0.1	0.08
1/26/65	G	1250	20.0	7.8	2	--	2040	7	3	<0.1	"
1/27/65	G	0815	20.0	7.4	37	--	2000	18	16	<0.1	"
1/27/65	G	1335	20.0	7.6	10	--	2440	14	8	<0.1	"
1/28/65	G	0750	18.0	7.5	3	--	2450	6	5	<0.1	"
1/28/65	G	1600	20.0	7.8	4	--	2500	13	7	<0.1	"
1/27/65	C	0830 to 1630	--	8.0	22	--	2060	15	6	<0.1	0.08
1/28/65	C	0800 to 1600	--	8.0	4	--	2790	16	10	<0.1	0.08

CAPITOL RENDERING COMPANY

58th Avenue and Weiby Street
Adams County, Colorado

Date of Visit: March 17, 1964

Person Contacted: George Mitchell, Superintendent

Process and Operation: The Capitol Rendering Company receives and renders edible and inedible material consisting of slaughterhouse and butcher-shop scraps together with a limited number of dead animals. The raw stock is converted into bone and meat meal and inedible tallows. Plant yield approximates 360,000 pounds of products per week. The cookers within the plant are operational over the full 24 hours of each working day.

The establishment normally operates 144 hours each week, with a maximum of about 150 hours per week. The average work is 312 days of each year with a maximum of 338 days a year. The entire staff consists of 14 plant employees and 6 office personnel.

Sources and Uses of Water: Plant process water primarily for cooling needs is obtained from two 35-foot wells at the average rate of 288,000 gallons per day. Boiler makeup water is received from a 680-foot well at the rate of 5,000 gallons per day. No treatment is provided for these waters. Domestic needs are served by bottled water.

Sources and Characteristics of Wastes: There are three types of liquid wastes emanating from the plant. Approximately 5,300 gallons of condensate waste waters are produced from the cookers. This waste is very high in entrained organic matter. The second category is represented by spent cooling waters amounting to 290,000 gallons per day. The cooling waters are low in organic matter but rather high in heat content with an effluent temperature around 75 degrees F. Lastly, sanitary sewage is collected within a septic tank on the plant site. Solid wastes consist of paunch manure which is collected for delivery to the Ruedy Fertilizer Company and grease cans which are cleaned and then hauled to the city dump.

Previous sampling of the plant wastes made by the Colorado State Department of Public Health in 1963 showed the following:

Total flow - 293,000 gallons/day
5-day BOD - 169 mg/l equal to 412 pounds BOD/day
Total suspended solids - 122 mg/l equal to 288 pounds TSS/day
Volatile suspended solids - 99 mg/l equal to 242 pounds VSS/day
Settleable solids - 0.76 ml/l

Treatment and Disposal of Wastes: The Capitol Rendering Company discharges its total process wastes into the South Platte River. Treatment facilities consist of two grease traps or basins providing a total detention time of 11 minutes. The grease traps are cleaned once each day. Cleaning consists of skimming grease off the top and then draining the basins. Solids remaining on the bottom are scooped off and removed to a dump area. Not all solids are removed by scooping and these are flushed to the drain leading to the River. The Capitol Rendering Company is undertaking negotiation and attempting to divert all plant wastes to the North Washington Sanitation District sewerage system. This arrangement if finalized, together with future plans for the North Washington Sanitation District to connect with the Metropolitan Denver Sewage Disposal District No. 1 treatment plant, will alleviate substantial pollution of the South Platte River now present.

APPENDIX B - TABLE IV

CAPITOL RENDERING COMPANY
DENVER, COLORADO
SAMPLING RESULTS

Discharge from 10-inch outfall to ditch into South Platte River

Dates of Sampling	Type of Sample	Time	pH	BOD mg/1	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Flow MGD
9/8/64	G	1345	--	205	132	104	0.2	0.35
9/8/64	G	1500	--	--	586	440	<0.1	"
9/9/64	G	0745	7.4	--	82	82	<0.1	"
9/9/64	G	1050	7.6	1500	1750	1350	10	"
9/9/64	G	PM	7.0	90	52	52	0.2	"
9/9/64	G	PM	6.8	>1980	4490	4640	12	"
9/10/64	G	0745	6.9	--	42	37	<0.1	"
9/10/64	G	1100	7.3	340	204	176	2.0	"
9/8/64 to 9/9/64	C	1100 1100	8.0	305	142	142	1.5	0.35
9/9/64 to 9/10/64	C	1100 1100	7.4	125	138	112	1.0	0.35

CHICAGO, BURLINGTON AND QUINCY RAILROAD
17th and Champa Street
Denver, Colorado
(Visit made to 23rd and Fox Street maintenance shop)

Date of Visit: August 19, 1964

Persons Contacted: B. F. Mcligan, Master Mechanic
Jack E. Schobert, Train Master and Road Foreman
E. A. Graham, Assistant Chief Engineer
Jim Rinehart, Secretary

Process and Operation: Company activities important to the industrial waste picture comprise the yard and equipment maintenance functions of the Chicago, Burlington and Quincy Railroad in the Denver area. The Chicago, Burlington and Quincy Railroad operates three maintenance shop areas located at 23rd and Fox Street, 38th and Washington Street, and near 31st and Perkins Street. Maintenance work is also provided by the Chicago, Burlington and Quincy Railroad for the Santa Fe Railroad locomotives at the 23rd and Fox Street location. Approximately 225 people are employed in the above activities which are continuous 24 hours a day, 7 days a week.

Sources and Uses of Water: At the 23rd and Fox Street shops two 700-foot wells supply water used in the powerhouse boiler, for locomotive and car maintenance and washing, and for floor washing. Reported average supply is 100,000 gallons per day. Domestic needs are served by the City and County of Denver.

The 38th and Washington Street location requires water only for domestic uses, and domestic wastes are discharged to the City of Denver municipal sewers. Incomplete water use data was obtained for the 31st and Perkins Street location, but it is known that these facilities provide for washing of cattle cars.

Sources and Characteristics of Wastes: Major emphasis was devoted to the waste picture at the 23rd and Fox Street location; the other two areas were believed to be of minor importance. Process wastes at the 23rd and Fox Street location originate from general maintenance and washing, and are high in oils and solids. Domestic wastes enter the sanitary sewer.

Treatment and Disposal of Wastes: Process wastes from the 23rd and Fox Street shops are passed through a settling tank separated into 6 chambers by means of baffles, and then discharged to the South Platte River. The settling unit is skimmed three to four times a week. The recovered oil is stored in a tank car and received by the Approved Drain Oil Company, Chicago, Illinois, for reclaiming. Settleable solids are removed from the settling unit on the average of once every 3 months.

APPENDIX B - TABLE V

CHICAGO, BURLINGTON AND QUINCY RAILROAD
DENVER, COLORADO
SAMPLING RESULTS

A) Discharge from 8-inch tile outfall to South Platte River sampled at far end of settling chamber

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TDS mg/1	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Oil mg/1	ABS mg/1	Flow MGD
7/17/64	G	1400	--	7.9	710	--	586	370	--	--	<0.1	--	2.0	0.40 a/
1/12/65	G	1020	19.0	7.6	260	406	--	--	174	174	0.4	154	--	"
1/12/65	G	1420	36.5	9.4	340	448	--	--	100	68	0.1	51	--	"
1/13/65	G	0915	17.0	7.5	400	418	--	--	220	73	0.2	205	--	"
1/13/65	G	1445	26.5	6.3	194	251	--	--	137	61	7.5	169	--	"
1/14/65	G	0700	36.0	8.6	660	1640	--	--	80	65	<0.1	178	--	"
1/14/65	G	0730	25.0	9.0	295	656	--	--	235	90	1.5	183	--	"
1/14/65	G	1000	34.0	8.7	190	170	--	--	147	91	2.5	62	--	"
1/14/65	C	0700 to 1500	--	8.2	245	226	--	--	79	48	<0.1	78	10.0	0.40

B) Discharge from 24-inch outfall to South Platte River

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TDS mg/1	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Oil mg/1	ABS mg/1	Flow MGD
7/17/64	G	1400	--	7.2	215	--	1140	807	--	--	0.1	--	9.8	.02
1/18/66	G	1000	23.0	7.0	68	134	438	--	96	22	0.1	--	18.1	"

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a/ The 8-hour daytime flow was equal to 0.18 million gallons or a daytime rate of 0.54 MGD as compared to the average 24-hour rate of 0.40 MGD.

15

COLORADO AND SOUTHERN RAILROAD
1917 7th Street
Denver, Colorado

Date of Visit: September 10, 1964

Persons Contacted: R. E. Hansen, General Foreman
G. W. Haffey, Principal Assistant Engineer

Process and Operation: Activities important to the industrial waste picture comprise the yard and equipment maintenance functions of the Colorado and Southern Railroad within the Denver area. The maintenance shops are located in the area surrounded by the Valley Highway, the 13th Street viaduct and Wazee Street. Approximately 200 people are employed in these activities which are continuous 24 hours a day, 7 days a week.

Sources and Uses of Water: All water, which was reported to average 50,000 gallons per day, is obtained from the City and County of Denver. Two low-pressure boilers, one gas-fired and the other coal-fired, supply heat and hot water for company operations as required. Approximately 17,000 gallons water per day are necessary for boiler feed and hot-water requirements. The Burlington Truck Lines leasing property from the Colorado and Southern Railroad obtain water through the Colorado and Southern meter for truck washing purposes. This need is about 15,000 gallons per day. The roundhouse area utilizes about 1,500 gallons of water per day for washing down and servicing locomotives. The remainder of water is directed to sanitary services.

Sources and Characteristics of Wastes: Major sources of waste are boiler blowdown; equipment and maintenance washings from the Burlington Truck Lines area and from the Colorado and Southern Railroad roundhouse area; and lastly, sanitary sewage. Domestic wastes are discharged to the City of Denver municipal sewers.

The liquid wastes from the Burlington Truck Lines washrack contain dirt, grease, detergents and miscellaneous. Wastewater from the roundhouse pits carries dirt, oil and detergents from the washing of locomotives, plus any oil and debris wasted to the pits during maintenance and repair operations.

Treatment and Disposal of Wastes: Wastes originating from the Burlington Truck Lines maintenance area receive no treatment and flow into a nearby storm sewer which empties to the South Platte River. Discarded waters from the roundhouse are allowed to accumulate in a large sump where some of the solid material settles out. The wastewaters are then pumped to an oil separator tank. Floating oils are skimmed off periodically and placed in a tank-truck. The effluents from the separator are piped for discharge to the South Platte River. These wastes entering the South Platte some 250 yards south of the 7th Street bridge were very black in color containing large amounts of oil.

APPENDIX B - TABLE VI

COLORADO AND SOUTHERN RAILPOAD
DENVER, COLORADO
SAMPLING RESULTS

A) Discharge from 6x8-inch outfall 150 yards north of 7th Street to South Platte River

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TDS mg/1	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Total Coliform MPN/100ml	Fecal Coliform MPN/100ml	Oil mg/1	ABS mg/1	Flow MGD
7/14/64	G	1115	--	8.8	3	--	734	353	--	--	1.0	--	--	--	<0.1	0.13
2/9/65	G	0820	9.0	7.4	26	210	328	--	267	71	1.5	--	--	22	--	"
2/9/65	G	1315	12.0	9.8	85	474	860	--	320	106	2.7	--	--	--	--	"

B) Discharge from wooden outfall 50 yards north of 7th Street to South Platte River

1/14/66	G	0800	28.0	7.8	<4	16	314	--	63	6	0.2	1,100	1.7	8	<0.1	0.01

C) Discharge from 8-inch outfall 250 yards south of 7th Street to South Platte River

2/8/65	G	1115	26.5	9.4	410	740	603	--	269	206	1.2	--	--	106	--	0.04
2/8/65	G	1440	24.0	9.0	185	323	550	--	139	119	<0.1	--	--	169	--	"
2/9/65	G	0805	25.0	9.2	160	644	595	--	119	106	<0.1	--	--	128	--	"
2/9/65	G	1300	26.5	9.2	190	565	588	--	129	26	0.1	--	--	105	--	"

D) Discharge from 24-inch outfall 150 yards south of 7th Street to South Platte River

7/14/64	G	1100	--	9.7	460	--	1430	1130	347	272	2.4	--	--	--	--	0.02
2/9/65	G	0815	16.0	8.4	32	511	89	--	409	93	6.0	--	--	--	--	"
2/9/65	G	1305	20.0	8.2	33	389	2820	--	500	92	7.0	--	--	137	--	"
1/14/66	G	0830	21.0	7.4	330	1380	--	--	1010	954	<0.1	13,000	3.3	857	0.2	"

COLORADO SCHOOL OF MINES
RESEARCH FOUNDATION, INC.
Golden, Colorado

Date of Visit: January 18, 1966

Persons Contacted: E. H. Crabtree, Director
Dr. Cliff Lewis, Director of Chemical Research
Anthony Scott, Manager of Construction and Maintenance

Process and Operation: The Colorado School of Mines Research Foundation, Inc., was established for the purpose of conducting research for the mineral industry, particularly in the mining area. Operations consist of three major divisions - mining, metallurgical, and chemical. The mining sector considers the various phases of mining projects starting with the initial exploration, through the design steps, to and including the final development. The metallurgical and chemical sectors devote primary attention to the design and operation of bench studies and pilot-plant models for process innovation, modification and development. The Foundation utilizes 150 persons on a 8-hour day, 5 days a week schedule.

Sources and Uses of Water: Plant water supply is received from the City of Golden and averages 40,000 gallons per day. Water is used for the various metallurgical and chemical processing activities in addition to domestic needs.

Sources and Characteristics of Wastes: The nature of operations indicate that significant inorganic metals and chemicals may be present in the plant wastes.

Treatment and Disposal of Wastes: Liquid wastes from sanitary facilities and the laboratory section are disposed of to the City of Golden municipal sewers. The remaining plant wastes enter a tailings pond 400 by 75 feet. The pond had a one-foot liquid depth when observed in January 1966. Inflow to the pond was estimated between 15,000 and 20,000 gallons waste per day. The liquid overflow from the tailings pond is discharged by means of a ditch into Clear Creek. Solid wastes originating within the plant are transported to the vicinity of North Table Mountain and disposed of by burying in accordance with AEC regulations.

APPENDIX B - TABLE VII

COLORADO SCHOOL OF MINES RESEARCH FOUNDATION, INC.
GOLDEN, COLORADO
SAMPLING RESULTS

Ditch outlet, from settling pond, into Clear Creek

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Total Coliform MPN/100ml	Fecal Coliform MPN/100ml	ABS mg/1	Flow MGD
1/19/66	G	1010	2.5	6.9	10	15	4200	24	9	0.2	<0.2	<0.2	0.9	<0.01

CONTINENTAL OIL COMPANY
5801 Brighton Boulevard
Commerce City, Colorado

Date of Visit: March 26, 1964

Persons Contacted: George A. O'Brien, Superintendent
W. C. Shrewsberry, Chief Chemist

Process and Operation: Major refinery operations include crude topping, thermal cracking (TCU), catalytic cracking (TCC), polymerization, and reforming. Crude oil is received by pipeline, the large majority from Wyoming. Crude oil plant input averages 17,500 barrels per calender day or 20,000 barrels per stream day. The crude normally contains around 0.25 percent sulfur with a maximum content of about 0.4 percent amounting to an average of 6.4 tons of sulfur received per day. In addition to crude, raw materials include 10,000 pounds per month of sodium hydroxide, 1,300 pounds per day of sulfuric acid, 40 pounds per day chromates, and 40 pounds per day phosphates. Finished products are gasoline, kerosene, furnace oil, diesel fuel, industrial fuel oil, propane, butane, asphalt and roofing tars.

The plant operates 24 hours per day, 7 days a week. There are approximately 6 weeks of shutdown each year - 3 weeks during the spring, 2 weeks in the fall and one week at any time during the year for maintenance and/or modification. Management and operation utilize 130 persons of which there are 15 persons on each of the second and third plant shifts during the night.

Sources and Uses of Water: The refinery receives its total water supply from seven wells which include 2 located adjacent to the Burlington-O'Brian Canal, 2 adjoining Sand Creek, and 3 within the plant grounds. Six of the wells are in the order of 40 feet deep and each delivers between 250 to 350 gpm. The seventh well drawing from the 600-foot level supplies boiler makeup water. The plant requires an average of 650 gpm or 0.94 MGD, of which approximately 0.65 MGD are dissapated through operation and 0.29 MGD are produced as liquid waste effluents.

Sources and Characteristics of Wastes: The major sources of refinery wastes are described as follows:

1. Sour water condensates from the cracking operations amounting to between 15 and 18 gpm. These streams contain complexes of ammonia, hydrogen sulfide and phenol. The condensates are collected separately, steam-stripped, and then fed to the bio-oxidation waste treatment unit.

2. Oily wastes such as pump gland losses and wash-up waters. These wastes are routed to the oil sewer system and then to the API separator where oil is recovered.

3. Boiler blowdown and sludges resulting from treatment of boiler-feed water.

4. Runoff collected by the storm sewer drains.

5. Caustic wastes resulting from process operations. These wastes are collected in a separate tank and transported elsewhere for the recovery of acid-oils.

6. Sanitary wastes are discharged to septic tanks.

Previous information collected by the Colorado State Department of Public Health in 1963 - 1964 on the character of total waste effluents from the refinery is given as follows:

	mg/l	Lbs/Day
Five-day BOD	25	60
Phenol	1	2.4
Oils	16	39
Cyanides	0.7	0.2
Hexavalent Chromium	3.8	8
Chlorides	265	636
Sulfates	947	2270
Alkalinity	166	398
Ammonia	50	120
ABS	2.7	6.5
Nitrates	1	2.4

Treatment and Disposal of Wastes: The treatment plant essentially comprises three units - the API separator, the bio-oxidation unit, and a holding or equilization tank. Oily wastes are directed to the API separator and then to the holding tank. Runoff from the storm sewers, and boiler blowdown and sludges from treating boiler water are transferred directly to the holding tank. The remaining process wastes from the plant are combined, treated by steam-stripping, bio-oxidation, and then discharged to the holding tank.

The API unit separates the oils from the wastewater. Floating oils are skimmed off and pumped to a slop oil tank for later treatment and recovery. Recovered oil amounts to about 30 barrels per day.

The majority of plant wastes are subjected to steam-stripping for removal of sulfur which is vented to the atmosphere. The partially treated wastes pass through a surge tank to the bio-oxidation unit. The oxidation process comprises three compartments in series and wooden cross members have been installed throughout to provide additional surface for biological growths. Waste inflows enter both the first and second compartments. The bio-oxidation unit provides approximately 2 days detention and treatment of wastes. Visual observations indicated that the mixed liquor in both the first and second compartments was very low in suspended solids content; the settling chamber contained considerable sludge; and the wastes were of straw-yellow color. The temperature of input wastes was about 145°F which decreased in the treatment process. Bio-oxidation was reported as reducing the phenol level from 300 to 400 mg/l in the entering wastes to 1.0 mg/l in the treated wastewater leaving the unit.

A holding tank 70-foot in diameter and 4-foot deep combines all treated and untreated wastewater from the plant and provides 8 to 10 hours detention for the wastewater. The effluent from the holding tank is discharged directly to the Burlington-O'Brian Canal. No visible oil was observed on the Canal at the times of plant visits.

The Continental Oil Company demonstrated an efficient waste control and treatment program at its Denver refinery. Officials are cognizant of the need for strict monitoring and plan additional in-plant changes which should further improve the quality of waste effluents. These changes include dehydration of the slop oil, higher efficiency in the sour water stripping, and greater oil recovery within the refinery.

APPENDIX B - TABLE VIII

CONTINENTAL OIL COMPANY
COMMERCE CITY, COLORADO
SAMPLING RESULTS

Discharge from 12-inch outfall to Burlington-O'Brian Canal

Dates of Sampling	Type of Sample	Time	Temp ^{o}C	pH	BOD mg/l	COD mg/l	Cond. umhos	TSS mg/l	VSS mg/l	Settl. Sol. ml/l	Oil mg/l	Phenol mg/l	Chrom. Total mg/l	Chrom. Hex. mg/l	Flow MGD
2/8/65	G	0935	28.5	6.7	32	268	3280	17	9	0.2	11	--	--	--	0.35
2/8/65	G	1335	29.5	7.0	42	92	3440	38	21	0.2	11	--	--	--	"
2/9/65	G	0920	29.0	8.0	48	140	3140	11	5	<0.1	6	--	--	--	"
2/9/65	G	1410	29.5	7.7	108	135	326	6	4	0.2	8	--	--	--	"
3/22/65	G	1305	32.5	7.8	>26	53	3920	35	14	0.1	7	0.56	--	--	"
3/23/65	G	0820	30.0	9.2	24	88	3770	24	11	<0.1	6	0.21	--	--	"
3/23/65	G	1300	31.0	8.7	21	80	2760	90	19	<0.1	4	--	--	--	"
3/24/65	G	0810	31.0	8.4	30	70	3590	24	12	<0.1	4	0.28	--	--	"
3/24/65	G	1330	32.0	8.8	28	90	2980	25	15	<0.1	4	0.11	0.8	0.44	"
3/25/65	G	1000	31.0	8.6	34	86	3330	38	20	0.4	7	0.21	1.0	0.48	"
3/22/65 to 3/23/65	C	1300 1300	--	8.8	19	67	3020	24	12	<0.1	--	--	--	--	0.35
3/23/65 to 3/24/65	C	1340 1340	--	8.6	32	80	3060	18	10	<0.1	--	--	--	--	0.35

ADOLPH COORS COMPANY (BREWERY)
Golden, Colorado

Date of Visit: June 2, 1964 and subsequent meetings

Persons Contacted: William K. Coors, President
Howard Lewis, Waste Recovery Department
Ed Edland, Engineering Department

Process and Operation: The Adolph Coors Company is one of the largest breweries in the United States. Company interests are family-owned and the entire manufacturing operations are at one location in Golden, Colorado. The Coors establishment has a leading growth-rate in the brewing industry. The Golden plant is unlike the industry in that it produces its own malt for the brewing process. Major raw materials comprise malt, hops, rice and yeast. The plant produces premium-quality beer at two levels of fermentation: 1) beer with less than 3.2 percent alcohol content; and 2) beer of greater than 3.2 percent but less than 6.0 percent alcohol content. The final product is sold in bottles, cans and kegs. Production in 1964 amounted to about 3.5 million barrels or an average of 10,000 barrels per day. Operation is on a round-the-clock basis with up to 2,000 persons (excluding salesmen and truck drivers) employed in the brewery and closely-associated functions.

Sources and Uses of Water: Plant water supply is obtained from three sources which include Clear Creek, a series of shallow wells, and various spring-fed underground streams. Clear Creek and the shallow well supplies are utilized essentially for cooling purposes, boiler feed supply, and for washing-down purposes within the plant. Clear Creek water amounting to about 2,500 gallons per minute is diverted into a large settling basin before use. Boiler feed supply receives demineralization, and washdown waters are treated by coagulation, settling, filtration and chlorination before use. Well water is delivered at the rate of approximately 1,000 gallons per minute. Spring water which is zealously protected from contamination before reaching the plant is employed directly in the manufacture of beer, and for drinking water needs.

Sources and Characteristics of Wastes: Cooling waters represent the largest volume of water used in the plant approximating 3.0 million gallons per day. This water after use is returned to Clear Creek. Process wastes originate from the fermenting room, bottling house, yeast house, malt house, the coal-burning room, the boiler house, and from floor and equipment spillage and cleanup. Hop press liquors, various condensates from the evaporation of spent yeast, liquors separated from spent hops and grams after fermentation, fly-ash from burning of coal, and numerous other waste streams are included in the total industrial wastewater. Spent yeast is specially dried and recovered solids, together with hops and grains residues are used for cattle feed.

The Adolph Coors Company owns and operates a full-scale waste treatment plant which not only receives the industrial wastes but also assumes full responsibility for treating the entire municipal wastes from the City of Golden. Information received from the Company in 1964 indicated the industrial plant waste flow (excluding direct-return cooling water) averaged 1.5 MGD during a 24-hour day with a maximum rate of 3.5 MGD during peak hours of the day. Municipal wastes averaged 1.2 MGD over a typical 24-hour day.

The composite industrial wastes leaving the brewery showed an average of 1150 mg/l 5-day BOD and 214 mg/l total suspended solids. Based on a production of 10,000 barrels per day, the BOD load approximated 1.44 pounds per barrel and suspended solids were 0.27 pounds per barrel processed. Calculated BOD and suspended solids loads in the total untreated industrial wastewater were 14,400 pounds BOD per day and 2700 pounds suspended solids per day. Municipal wastes contained approximately 2500 pounds BOD per day.

A subsequent visit was made to the Adolph Coors Company in October 1966 to determine changes occuring since early 1964. The waste load originating from the Company had greatly increased due to expansion and modification. The waste flows received from the City of Golden were also considerably larger arriving at the waste treatment plant. The average daily input of total wastes to the treatment plant were estimated as 25,000 pounds 5-day BOD contained in a flow of 3.1 MGD. Peak flows exceeded 4.5 MGD. The most significant change at the industrial establishment was the transfer of strong condensates from the yeast recovery room to the sewage treatment plant. These condensates originating from the barometric leg of the first-effect evaporator and equivalent to 8,000 pounds of BOD per day had been previously discharged to Clear Creek. Remaining wastes entering Clear Creek are given in the discussion below.

Treatment and Disposal of Wastes: The waste treatment plant receives practically all the wastes from the Adolph Coors Company together with municipal wastes from the City of Golden. The various treatment operations include primary settling, 12 activated sludge chambers equipped with mechanical aeration turbines (to be expanded to 24 in late 1966), secondary settling with sludge return to the aeration basins, chlorination, and sludge digestion. Digested sludge is further concentrated and dewatered by floatation and vacuum filtration and disposed of to farmers' lands. A recurrent problem at the treatment plant involves a high rate of infiltration flow in the municipal sewer system during times of heavy runoff. These wet-weather flows reduce treatment plant efficiency.

In 1964 it was reported that the final effluent from the waste treatment plant averaged 30 mg/l BOD and 20 mg/l total suspended solids for respective daily loads of 675 pounds and 450 pounds. Plant removal of organics and suspended solids were rated at 95 and 89 percents respectively. Data received from the Company in October 1966 indicated the much higher input load had increased the final effluent BOD to 80 mg/l with a resulting waste load to Clear Creek of 2100 pounds BOD per day. BOD removal by plant treatment was 92 percent in late 1966.

Four other waste flows from the Adolph Coors Company were observed reaching Clear Creek at the time of plant visit in October 1966. These included spent cooling waters from the boiler house, fly-ash effluent from the coal-burning room, boiler-blowdown, and residual condensates from the yeast recovery room. The strong condensates from the yeast recovery room were mentioned previously as being diverted to the sewage treatment plant. Remaining wastes from yeast-drying entering the stream were roughly estimated in the order of 1 cfs flow with 50 mg/l BOD providing therefore a total load of around 300 pounds per day. These waste flows although minor compared to the total entering the treatment plant, will need to be considered in greater detail in the future.

The Adolph Coors Company even with its high degree of industrial waste treatment is in a difficult position because Clear Creek passing the plant has a very small flow during most of the year. Irrigation interests divert large quantities of water above the plant leaving very little flow in the stream. Protection for a wide range of water uses would logically demand virtually no waste loads entering the stream unless greater stream flows were made available. In other words Adolph Coors Company regardless of treatment efficiency, cannot feasibly improve the stream beyond its single-use for agricultural irrigation water. The overall solution lies in a future shift of water-use allocation and development of a comprehensive water-resources management program by the State of Colorado.

Stream sampling results of March 1965 included in this report show very small flows in Clear Creek at Golden resulting in a high relative degree of pollution existing at that time. Stream pollution in 1966, after removal of the strong condensates from yeast recovery by the Adolph Coors Company, are expected to be around one-fourth of the waste levels shown in March, 1965.

APPENDIX B - TABLE IX

ADOLPH COORS COMPANY
GOLDEN, COLORADO
SAMPLING RESULTS

Clear Creek sampled approximately 200 yards downstream
of Adolph Coors Company sewage treatment plant

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/l	COD mg/l	Cond. umhos	TSS mg/l	VSS mg/l	Settl. Sol. ml/l	Flow MGD
3/15/65	G	1320	11.0	8.0	105	129	377	153	36	1.0	Low flow - not determined
3/16/65	G	0835	9.0	7.8	72	118	535	66	27	0.2	"
3/16/65	G	1245	13.5	7.4	>315	450	435	65	12	0.3	"
3/17/65	G	0920	4.0	7.6	152	120	396	257	40	2.0	"
3/17/65	G	1250	6.0	7.8	145	117	342	200	29	1.0	"
3/18/65	G	0900	5.0	7.8	9	70	497	94	26	3.0	"

APPENDIX B - TABLE X

ADOLPH COORS COMPANY
GOLDEN, COLORADO
SAMPLING RESULTS

Clear Creek sampled upstream of Adolph Coors Company and Coors Porcelain Company at Ford Street bridge in Golden

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Flow MGD
3/15/65	G	1230	4.0	7.7	2	2	263	29	9	<0.1	Not determined
3/16/65	G	0930	1.0	7.8	4	12	272	80	27	0.5	"
3/16/65	G	1230	4.0	7.1	3	13	233	56	24	0.2	"
3/17/65	G	0900	0.0	7.6	--	4	262	62	10	0.5	"
3/17/65	G	1255	0.0	7.6	4	13	260	111	13	0.4	"
3/18/65	G	0920	0.0	8.0	8	16	306	193	20	0.9	"

COORS PORCELAIN COMPANY
600 Ninth Street
Golden, Colorado

Date of Visit: January 13, 1966

Persons Contacted: Don Philp, Plant Process Engineer
Howard Lewis, Waste Recovery Department,
Adolph Coors Brewery

Process and Operation: The Coors Porcelain Company is the largest producer in the world of chemical and scientific porcelain ware and in addition is a major producer of industrial ceramics. The plant also manufactures aluminum cans for the Adolph Coors Brewery and conducts extensive research in the field of ceramics and porcelain ware. Diagrammatic representations of the manufacturing operations are shown in the figure accompanying this plant report.

The Company employs about 1,000 persons working on 3 eight-hour shifts in a round-the-clock operation.

Sources and Uses of Water: Total plant water supply at present time is obtained from the City of Golden and amounts to an average of 113,000 gallons per day. A supplemental well supply will be added in the future.

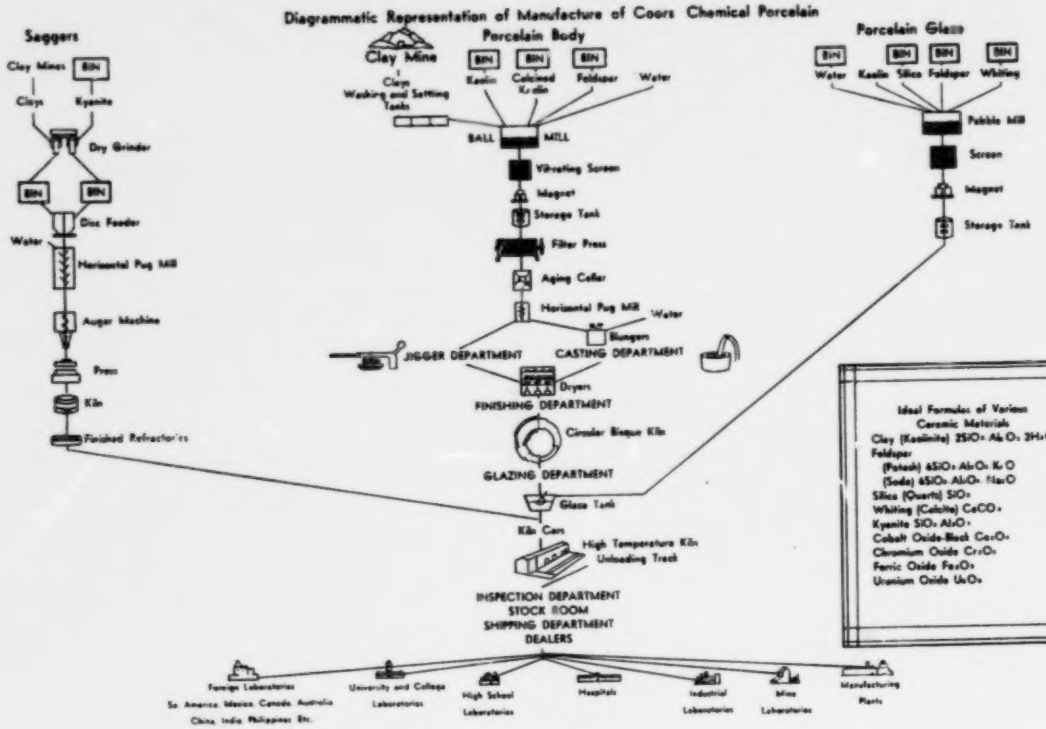
Water uses within the plant include various process operations, domestic needs, air conditioning, boiler makeup supply, cooling of the ball mills, and equipment and floor washing.

Sources and Characteristics of Wastes: Major liquid wastes originate from the floor drains, air conditioners, sanitary facilities, washing and cleaning, and from filtering process operations.

Treatment and Disposal of Wastes: The plant reportedly discharges about 40,000 gallons of waste per day to the City of Golden municipal sewers. This volume is comprised of sanitary sewage, floor drainage, ceramic and porcelain plating rinse waters and washing waters. Approximately 35,000 gallons per day of wastewater are discharged into Tucker Gulch leading into Clear Creek directly below the plant. The wastes released directly to the receiving stream include excess spent waters from the air conditioners, storm drains and floor drains. The floor drains in this case collect wastewater from filtering process and washing operations, and contain appreciable quantities of inorganic clays together with small amounts of organic binders. The wastes entering the stream contain a small portion of readily decomposable organic matter but are very high in solids material. The remainder of in-plant water supply is evaporated through air conditioning, water-cooling and drying operations, and does not appear in the factory waste effluents.

The Coors Porcelain Company separately collects and treats the cyanide plating wastes within the plant. The Company at present time is studying the problem of waste discharge into Tucker Gulch. Proposed solutions include: 1) removal of the small quantities of organic binders; 2) waste settling before discharge either to the stream or to the municipal sewage treatment plant and; 3) piping all wastes directly to the sewage treatment plant. In the future, the Company will construct a new plant for additional manufacturing of aluminum cans. Treatment facilities will be incorporated for recovery of hexavalent chromium from the process waters and re-use of these waters in the operations.

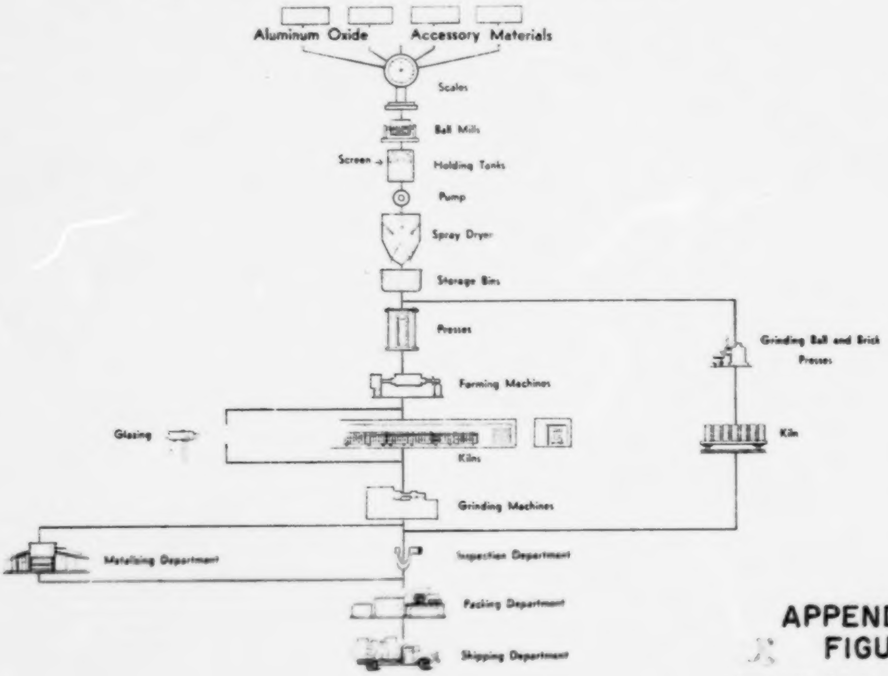
Diagrammatic Representation of Manufacture of Coors Chemical Porcelain


Saggers
Clay Mines
BIN
Clays
Kyanite
Dry Grinder
BIN
BIN
Disc Feeder
Water
Horizontal Pug Mill
Auger Machine
Press
Kiln
Finished Refractories
Clay Mine
Clays
Washing and Settling Tanks
Porcelain Body
BIN
Kaolin
BIN
Calcined Kaolin
BIN
Feldspar
Water
BALL
MILL
Vibrating Screen
Magnet
Storage Tank
Filter Press
Aging Cellar
Horizontal Pug Mill
Water
Blungers
JIGGER DEPARTMENT
CASTING DEPARTMENT
Dryers
FINISHING DEPARTMENT
Circular Bisque Kiln
GLAZING DEPARTMENT
Glaze Tank
Kiln Cars
High Temperature Kiln
Unloading Track
INSPECTION DEPARTMENT
STOCK ROOM
SHIPPING DEPARTMENT
DEALERS
Foreign Laboratories
So. America, Mexico, Canada, Australia
China, India, Philippines Etc.
University and College Laboratories
High School Laboratories
Hospitals
Industrial Laboratories
Mine Laboratories
Manufacturing Plants
Porcelain Glaze
BIN
Water
BIN
Kaolin
BIN
Silica
Feldspar
BIN
Whiting
Pebble Mill
Screen
Magnet
Storage Tank

Ideal Formulas of Various Ceramic Materials

Clay (Kaolinite) $2SiO_2\ Al_2O_3\ 2H_2O$
Feldspar
  (Potash) $6SiO_2\ Al_2O_3\ K_2O$
  (Soda) $6SiO_2\ Al_2O_3\ Na_2O$
Silica (Quartz) SiO_2
Whiting (Calcite) $CaCO_3$
Kyanite $SiO_2\ Al_2O_3$
Cobalt Oxide-Black Co_3O_4
Chromium Oxide Cr_2O_3
Ferric Oxide Fe_2O_3
Uranium Oxide U_3O_8

Diagrammatic Representation of Manufacture of Coors Industrial Ceramics


Aluminum Oxide
Accessory Materials
Scales
Ball Mills
Screen →
Holding Tanks
Pump
Spray Dryer
Storage Bins
Presses
Grinding Ball and Brick Presses
Forming Machines
Glazing
Kilns
Kiln
Grinding Machines
Metalizing Department
Inspection Department
Packing Department
Shipping Department

APPENDIX B
FIGURE I

by courtesy of Coors
Porcelain Company

APPENDIX B - TABLE XI

COORS PORCELAIN COMPANY
GOLDEN, COLORADO
SAMPLING RESULTS

Waste discharge from plant sampled at manhole on southside of building immediately south of fence-line, before discharge to Tucker Gulch

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Flow MGD
3/15/65	G	1220	14.0	7.4	38	65	377	--	--	2.0	0.03
3/16/65	G	0920	14.0	8.4	54	77	521	2260	152	3.8	"
3/16/65	G	1235	14.0	4.6	37	221	706	934	174	0.3	"
3/17/65	G	0905	10.0	7.8	12	14	393	788	57	5.0	"
3/17/65	G	1240	7.0	7.7	38	138	525	3290	208	2.6	"
3/18/65	G	0850	9.0	8.8	49	92	543	8950	642	22.5	"
to 3/15/65 3/16/65	C	0930 0930	--	8.2	22	47	411	1728	200	22.5	0.03
to 3/16/65 3/17/65	C	0930 0930	--	8.0	162	160	427	3464	256	15.0	0.03

DENVER AND RIO GRANDE WESTERN RAILROAD
1531 Stout Street
Denver, Colorado

(Visit made to the Burnham Shops of the
Denver and Rio Grande Western Railroad)

Date of Visit: August 18, 1964

Persons Contacted: Keith W. Bradley, Design Engineer
Henry Koch, Water Service Superintendent
Mr. Atkins, Superintendent of Structures

Process and Operations: Activities of the Company important to the industrial waste picture comprise the yard and maintenance functions of the Denver and Rio Grande Western Railroad in the Denver area. The maintenance shops of the Denver and Rio Grande Western Railroad are located in the area surrounded by the Valley Highway, the 6th Avenue Viaduct, 12th Avenue, and Osage Street. Activities are conducted on a 24-hour daily basis, 7 days a week.

Sources and Uses of Water: Total plant water supply is received from two 800-foot deep wells, one situated at 12th Avenue and the other at 5th Avenue. Average water use approximates 30,000 gallons per day of which 27,000 gallons per day are utilized for washing and cleaning passenger cars. The remainder of water is directed to sanitary needs, the cooling of locomotives, and the air-conditioning of passenger cars and the buildings. Small amounts of water are also necessary as boiler feed supply.

Sources and Characteristics of Wastes: The majority of process wastes originate from the washing, cleaning and maintenance of equipment and yard facilities. The spent waters are characterized by solids and oil. Domestic wastes are discharged to the City of Denver municipal sewers.

Treatment and Disposal of Wastes: Plant wastes are passed through four grit chambers each 5 feet in diameter and then to an oil separator constructed from a 10,000 gallon tank car. The maximum rate of flow to this first oil separator is designated as 600 gallons per minute.

Partially-treated wastes then flow through a 10,000 gallon storage tank which provides for additional separation of oil. The wastes leave the second oil separator and enter a pipeline under the 6th Avenue Viaduct leading to the South Platte River. The pipeline wastes before reaching the River flow into a large grit chamber which provides further removal of undesirable contaminants. The final wastes enter the River at 7th Avenue by means of a 72-inch concrete outfall.

The separators and grit traps are cleaned only about twice each year. The large majority of oil drained from the locomotives at the maintenance shop is collected for eventual reclaiming by the Williams Refining Company of Denver.

APPENDIX B - TABLE XII

DENVER AND RIO GRANDE WESTERN RAILROAD
DENVER, COLORADO
SAMPLING RESULTS

Discharge from 72-inch outfall to South Platte River at 7th Avenue

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Oil mg/1	ABS mg/1	Flow MGD
1/12/65	G	0935	21	--	>1320	--	--	--	0.3	555,000	--	0.21
1/12/65	G	1335	17	9.6	>1380	--	1640	1160	58.0	3,710	--	"
1/13/65	G	0745	11	7.0	265	540	20	4	<0.1	804	--	"
1/13/65	G	1420	14	6.6	460	1220	266	196	<0.1	770	--	"
1/14/65	G	0700	11	7.3	190	554	32	24	<0.1	496	--	"
1/14/65	G	1445	15	7.6	400	853	76	53	<0.1	884	--	"
1/14/65	C	0700 to 1500	--	8.0	220	--	47	34	<0.1	37	24	0.21

DENVER UNION STOCKYARD COMPANY
Extending from 46th Avenue to Race Court
on east side of South Platte River
Denver, Colorado

Date of Visit: Fall and Winter 1964-1965

Discussion: Only limited information was obtained on the process operations, and sources and magnitude of wastes within the Denver Union Stockyard Company. The Denver Union Stockyard Company is the principal livestock market and holding facility serving the meat industry in the Denver Metropolitan area. The Company maintains a total of 56 acres of holding pens of which 41 acres are unsurfaced and without shelter, and the remaining 15 acres are concrete-lined with sheltering provided. The open area is generally utilized for holding of cattle whereas the sheltered area is reserved for confinement of hogs. Sheep are also housed in the Stockyard complex.

Spent livestock drinking water, unknown quantities of manure, and miscellaneous drainage from the pen areas are believed to represent the major wastes from the Denver Union Stockyard Company. It is understood that the Company has an arrangement with the City and County of Denver whereby spent livestock drinking water is discharged to the sanitary sewers during the hours of 8 AM to 6 PM, and to the South Platte River during the remainder of the day. The reasons for restricting the amount of wastewater to the municipal sewers are not known.

The Denver Union Stockyard Company has four known points of liquid waste discharge to the South Platte River. One drainage line serves the south cattle pens and culminates in a 12-inch outfall intercepting the River 100 yards south of the cattle overpass at RM 314.9. This outfall was not sampled during the Industrial Waste Survey. The other three lines originate respectively from the sheep pen area, the hog pen area, and the north cattle pen area, and enter the River between RM 314.8 and 314.4. Study of these three outfalls showed that reported drainage from the sheep pen area was by far, the most serious from the standpoint of stream pollution.

APPENDIX B - TABLE XIII

DENVER UNION STOCKYARD COMPANY
DENVER, COLORADO
SAMPLING RESULTS

24-inch outfall from sheep pen area, to South Platte River 10 feet north of cattle overpass

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Flow MGD
12/1/64	G	1000	--	7.3	94	--	409	134	110	1.2	1.8
12/1/64	C	1420	--	7.4	24	--	446	30	22	<0.1	"
12/2/64	G	0815	--	7.4	12	--	443	16	12	<0.1	"
12/2/64	G	1120	--	7.5	--	--	380	20	17	<0.1	"
12/3/64	G	1030	--	7.4	19	--	460	31	30	<0.1	"
12/3/64	G	1345	--	7.5	22	--	501	38	35	0.3	"
12/8/64	G	1445	--	7.9	>655	1300	690	1220	1040	7.0	"
12/8/64	G	1820	--	7.6	22	41	443	620	15	0.2	"
12/8/64	G	2253	--	7.5	42	69	448	75	65	0.3	"
12/10/64	G	0700	--	7.6	24	37	460	22	22	0.1	"
12/10/64	G	0800	--	7.5	47	47	453	26	26	0.2	"
12/1/64 to 12/2/64	C	1100 1130	--	7.6	17	--	465	30	22	<0.1	1.8
12/2/64 to 12/3/64	C	1130 1130	--	7.4	145	--	465	148	130	0.8	1.8
12/9/64 to 12/10/64	C	1145 1145	--	7.7	117	115	500	75	61	<0.1	1.8

APPENDIX B - TABLE XIV

DENVER UNION STOCKYARD COMPANY
DENVER, COLORADO
SAMPLING RESULTS

24-inch outfall from hog pen area, to South Platte River 300 yards
south of main sewer trunk line crossover

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Flow MGD
12/1/64	G	1000	--	7.4	32	436	34	30	0.1	0.08
12/1/64	G	1430	--	7.5	25	400	37	20	<0.1	"
12/2/64	G	0800	--	7.4	10	400	16	12	<0.1	"
12/2/64	G	1115	--	7.5	24	440	20	14	<0.1	"
12/3/64	G	1030	--	7.4	14	425	20	20	0.1	"
12/3/64	G	1340	--	7.5	13	436	11	11	<0.1	"
12/2/64 to 12/3/64	C	1000 1000	--	7.4	50	450	21	18	<0.1	0.08

APPENDIX B - TABLE XV

DENVER UNION STOCKYARD COMPANY
DENVER, COLORADO
SAMPLING RESULTS

24-inch outfall from north cattle pen area sampled at manhole on property of Race Court Fertilizer Company, to South Platte River 100 yards north of main sewer trunk line crossover

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Flow MGD
1/26/65	G	0835	9.0	7.4	4	1230	20	13	0.2	0.46
1/26/65	G	1220	8.0	7.6	3	1240	< 1	< 1	< 0.1	"
1/27/65	G	0815	8.0	7.5	3	1140	13	10	< 0.1	"
1/27/65	G	1405	9.0	7.4	28	1350	64	59	< 0.1	"
1/28/65	G	0805	8.0	7.5	10	1225	18	14	< 0.1	"
1/28/65	G	1520	9.0	7.8	4	1370	8	5	< 0.1	"
1/25/65 to 1/26/65	C	1000 1000	--	7.6	4	1300	19	12	< 0.1	0.46
1/27/65 to 1/28/65	C	1000 1000	--	7.6	4	1280	10	9	< 0.1	0.46

E. I. DU PONT DE NEMOURS AND COMPANY
Louviers, Colorado

Date of Visit: June 30, 1964

Persons Contacted: E. E. Stewart, Plant Manager
Jess Franklin, Service Supervisor
C. E. Watkins, Assistant Plant Manager
Jack Hawdon, Power and Maintenance Superintendent

Process and Operation: The Louviers plant of the E. I. Du Pont de Nemours and Company manufactures explosives and associated products. Raw materials for process include anhydrous ammonia, fuming sulfuric acid, and inexpensive organic fillers such as barley husks and/or shells. The only requirements made of the fillers are that they freely ignite and burn. Dynamite is the major finished product. Nitric acid occuring as an intermediate product is also sold in small amounts. Nitroglycerine, another intermediate product is completely used within the process for the manufacture of dynamite.

The Company employs 150 persons of which 25 are office personnel. The schedule is 8 hours a day, 5 days a week. Eleven persons are utilized for maintenance on the off-shift hours.

Sources and Uses of Water: The Company maintains three wells for process and domestic water supply. The wells range in depth from 34 to 820 feet and from 210 to 365 gallons per minute at full capacity. The one shallow well is used exclusively for cooling purposes, whereas the two deep wells (765 and 820 feet) are employed for cooling, boiler feed water, ammonium nitrate processing (intermediate step in producing dynamite), and domestic needs. The water for domestic purposes is chlorinated before use.

Sources and Characteristics of Wastes: The majority of wastewater volume originates as spent cooling water from the acid tanks. The spent cooling waters amount to about 430,000 gallons accumulated over a 4-day period during each week or 108,000 gallons per process day. This wastewater over 4 days is reported to contain approximately 40 pounds each of nitric acid and sulfuric acid. Waste effluents are produced from the nitroglycerine manufacturing process during 6 hours of the day, 5 days each week and amount to about 18,000 gallons per process day. The small amounts of nitroglycerine contained in the effluents are rapidly oxidized by natural means to harmless, inorganic salts.

Fuming sulfuric acid after use is collected separately and sold to a local wire manufacturing company.

Treatment and Disposal of Wastes: The coolant wastewaters from the acid tanks together with boiler blow-down, and excess cooling water from the powerhouse are released without treatment to a drainage ditch which enters Plum Creek. Liquid wastes resulting from the manufacture of ammonium nitrate and from the nitroglycerine process are discharged into an industrial waste pond located near Plum Creek. The contents of the pond are reported to be disposed of entirely by evaporation and seepage. Domestic wastes are removed to septic tanks followed by leaching fields.

APPENDIX B - TABLE XVI

E. I. DU PONT DE NEMOURS AND COMPANY
LOUVIERS, COLORADO
SAMPLING RESULTS

A) Spent coolant waters leaving plant sampled within drainage ditch leading to Plum Creek

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	NO_3 as N mg/1	Flow MGD
3/8/65	G	1320	30.0	8.6	2	8	594	7	6	<0.1	8	0.8
3/9/65	G	0950	24.0	8.2	2	8	552	4	4	<0.1	11	"
3/9/65	G	1345	24.0	8.7	4	8	611	7	7	<0.1	9	"
3/10/65	G	1010	26.0	8.3	--	3	577	5	3	<0.1	13	"
3/10/65	G	1400	26.0	8.4	2	9	565	10	7	<0.1	18	"
3/11/65	G	1015	27.0	8.0	6	5	620	4	4	<0.1	10	"
3/8/65 to 3/9/65	C	1030 1030	--	8.3	1	8	785	0	0	<0.1	14	0.8
3/9/65 to 3/10/65	C	1030 1020	--	7.4	--	--	727	4	3	<0.1	10	0.8

B) Process wastes immediately before discharge to industrial waste pond

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	NO_3 as N mg/1	Flow MGD
3/8/65	G	1410	14.0	7.7	189	896	32,300	768	362	--	300	0.03
3/9/65	G	1005	0.0	8.3	62	503	7,290	324	187	0.6	734	"
3/9/65	G	1405	3.0	8.1	216	983	6,640	645	456	5.5	734	"
3/10/65	G	0940	4.0	8.6	190	442	4,880	535	348	2.5	483	"
3/10/65	G	1420	13.0	9.5	50	355	3,140	284	104	0.6	226	"
3/11/65	G	1050	8.0	8.6	206	1,210	16,600	454	392	4.0	17,760	"
3/8/65 to 3/9/65	C	0950 0950	--	8.1	60	780	18,500	211	92	0.5	1,970	0.03
3/10/65 to 3/11/65	C	1045 1045	--	8.8	39	222	2,000	--	--	0.6	115	0.03

EMPIRE PETROLEUM COMPANY
(CONOCO ASPHALT COMPANY)
3975 East 58th Avenue
Commerce City, Colorado

Date of Visit: April 9, 1964

Person Contacted: L. R. Cox, Vice-President

Process and Operation: The Denver plant of the Empire Petroleum Company is basically an asphalt refining operation although smaller amounts of straight-run gasoline, kerosene, furnace oil, diesel fuel, and industrial fuel oil are also produced. A crude oil input of 3,000 to 3,500 barrels per day is received via pipeline from the Wyoming oil fields. Caustic soda is employed in refinery processing at the rate of about 300 gallons per week.

The plant employs 35 persons in refinery operations, 10 to 12 office personnel, and an unidentified number of truck drivers. Normal operation is maintained 24 hours a day, 7 days a week. Shutdown periods are necessary for general maintenance and amount to about 4 weeks each year - generally 2 weeks during the spring and 2 weeks in the fall.

Sources and Uses of Water: Plant process water is obtained from 3 wells located on plant property near Sand Creek, 2 of which are operating at any one time. The three wells are each 50-foot deep with rated capacities from 300 to 500 gallons per minute. Total water supply averages about 290,000 gallons per day. The majority of water is used for cooling purposes on a once-through basis with little loss in process operations. Boiler makeup water is treated before use by two zeolite filters.

Sources and Characteristics of Wastes: The majority of waste load originates from the barometric condenser located on the vacuum distillation tower. There is some entrainment of oil in the vacuum chamber with subsequent carry-over to the condensate waters. Other wastes include the caustic wash, pump gland leakage. spent cooling waters, sour water, boiler blow-down, and floor drains. The sanitary sewage is discharged to a septic tank followed by a leaching field.

Treatment and Disposal of Wastes: Processing wastes are segregated and directed to two oil separators. The south separator which is 9 feet wide, 18 feet long and 10 feet deep receives the barometric condensates and spent cooling waters. At the time of plant visit, the surface oil layer on the tank ranged up to 6 inches thick but was more or less dispersed into clumps or patches along the tank. The north separator which is 10 feet wide, 18 feet long and 10 feet deep receives the wastes from the processing area and floordrains, together with boiler blowdown. The oil layer on this tank was observed to be about 2 inches in depth.

The effluents from the two separators are next combined in a large retention pond. A dense black oil layer about 12 inches in depth was noted over the pond surface. The pond outlet is located approximately 5 feet below the liquid surface and the final effluent empties into a ditch which flows about 100 yards and enters Sand Creek. Some discoloration was observed in the effluent but no evidence of discrete oil particles was present either in the effluent or in the ditch.

The separators and the retention pond are skimmed periodically for recovery for oil. The oil is collected into a slop tank and amounts to about 107 gallons per day which is returned to the refinery for reprocessing or reclaiming.

APPENDIX B - TABLE XVII

EMPIRE PETROLEUM COMPANY
COMMERCE CITY, COLORADO
SAMPLING RESULTS

Discharge immediately before entering ditch leading to Sand Creek

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Oil mg/1	Phenol mg/1	Flow MGD
10/6/64	G	1015	33.0	8.3	59	76	18	15	<0.1	21	1.48 a/	0.45
10/6/64	G	1400	34.5	8.4	50	79	17	17	<0.1	7		"
10/6/64	G	1540	34.0	8.2	48	102	18	15	<0.1	13		"
10/7/64	G	0825	34.0	8.1	34	99	14	14	<0.1	10	0.24 a/	"
10/7/64	G	1030	34.0	8.4	36	101	13	13	<0.1	10		"
10/7/64	G	1340	34.5	8.4	37	97	23	23	<0.1	12		"
10/8/64	G	0735	34.0	8.3	39	95	11	7	<0.1	8	0.50 a/	"
10/8/64	G	1030	34.0	8.4	36	95	19	12	<0.1	10		"
10/8/64	G	1245	35.0	8.4	40	110	14	12	<0.1	<1		"
10/6/64 to 10/7/64	C	1030 1030	--	8.2	18	54	8	8	<0.1	5	--	0.45
10/7/64 to 10/8/64	C	1030 1030	--	8.3	23	62	10	10	<0.1	2	--	0.45

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a/ The numerical value represents a composite of three grab samples.

GATES CYCLO POULTRY FARM

(HENRIETTA FARMS)
Route 2, Box 13
Brighton, Colorado

Date of Visit: June 26, 1964

Person Contacted: James Helbig, Vice-President

Process and Operation: The Gates Cyclo Poultry Farm is devoted to the large-scale production of eggs for market. The Company also maintains hatching facilities to sustain the large population of birds on hand. In mid-1964, the population consisted of 90,000 laying hens and 18,000 chicks. The farm at that time had a reported capacity for 100,000 laying hens and 36,000 chicks. Future plans envisioned expansion in 1965 to 150,000 laying hens.

The birds are maintained in a carefully-controlled, atmospherically-conditioned environment to encourage maximum egg production. The poultry are enclosed within a total of eight buildings and kept in separate cages for most of their life cycle.

The Company operations are maintained over 24 hours, 7 days a week. Most of the work is undertaken during the daytime period, and cleanup is normally scheduled each day from 7 AM to 3 PM. Twenty-three full-time employees have control over the highly-automated plant operations.

Sources and Uses of Water: The entire plant water supply is obtained from two wells. The first well, 40 feet deep with a capacity of 600 gallons per minute, supplies drinking water for the poultry, makeup water for the air-conditioning units in the various buildings, and water used in cleanup of the pens and floors of the poultry houses. This well supply is chlorinated with up to 10 mg/l chlorine, before use.

The second well, 1,000 feet deep with a capacity of 15 gallons per minute, delivers water for domestic needs, and for boiler makeup. No treatment is provided for this supply prior to use.

Sources and Characteristics of Wastes: The large majority of plant waste load originates from the cleaning and removal of manure, waste feed, and feathers accumulated on the pens and floors of the poultry buildings. Dead birds are passed through a grinder and these remains together with broken eggs and miscellaneous material constitute the remainder of plant waste load. It must be noted that the Gates Cyclo Poultry Farm is not a poultry processing operation. The wastes from this plant approximate in some degree the old-type processing establishment which held the birds in cages or batteries for 1 to 10 days before killing, and where manure was the major waste load. The reader is referred to the publication on "Wastes from the Poultry Processing

Industry" by Porges and Struzeski, Robert A. Taft Sanitary Engineering Center Technical Report W62-3, Cincinnati, Ohio, 1962 - for further information on the nature and magnitude of these wastes.

Domestic wastes from the Gates Cyclo installation were collected separately and placed in a septic tank followed by a leaching field.

Treatment and Disposal of Wastes: Process wastes flow by gravity to a 12-acre lagoon located adjacent to the South Platte River. The liquid depth in the lagoon was observed to vary from one to five feet because of an uneven bottom in the pond. A definite odor was noted on June 26, 1964 near the influent end of the lagoon. The outlet structure is located on the east side of the lagoon and effluent travels about 150 feet in a drainage ditch which in turn enters the South Platte River. No chlorination is provided for this effluent. In June 1964, the discharge area of the lagoon was bright-pink in color indicating the presence of a specific bacterial or algal form highly adaptable to the available environment at that time. The appearance of the lagoon was unnatural and in this connection unappealing to the aesthetic senses.

The shallow well previously described, supplies water to the plant on a continuous, 24-hour basis and subsequently this flow is delivered to the waste lagoon throughout the entire day. Therefore the rate of flow into the lagoon was judged to be more or less constant and independent of the cleaning cycle. The continuous flow approximated 1 cfs. On the other hand, cleanup accounts for the majority of waste load from the plant and these wastes enter the pond over a 10-hour period between 7 AM and 5 PM.

The Company has experienced major problems with the odors arising from the waste treatment lagoon for the last two to three years. The lagoon was grossly overloaded in 1964 and since that time with plant expansion, waste loads have further increased. Treatment facilities are far from adequate and solutions have not been found. During the spring and summer of 1965 the Company discharged its wastes into Brantner Canal rather than to the lagoon. The application of this waste onto farmers' lands mixed together with the irrigation water supply in the Brantner Canal was encouraged on the basis of the fertilizing values present in the wastewater. This arrangement was discontinued in late 1965 because of many undesirable factors and the wastes are once again being discharged to the lagoon. From a search of the literature, it would appear that odors from an overloaded lagoon would be most severe with the onset of spring and continuing for many weeks thereafter. Because of atmospheric inversion occurring frequently in the South Platte River valley, odors from the Gates Cyclo Poultry Farm theoretically could be detected at great distances from the lagoon. Documented information on this issue is relatively scarce, but the opinions of local residents are plentiful regarding the undesirable odors from the Gates Cyclo operations.

APPENDIX B - TABLE XVIII

GATES CYCLO POULTRY FARM
(HENRIETTA FARMS)
BRIGHTON, COLORADO
SAMPLING RESULTS

A) Waste flow into treatment lagoon

Dates of Sampling	Type of Sample	Time	Temp °C	pH	Diss. Oxygen mg/1	BOD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Total Coliform MPN/100ml	Fecal Coliform MPN/100ml	Flow MGD
6/30/64	G	1420	15.6	--	1.1	--	--	--	--	--	110,000,000	110,000,000	0.65
6/30/64	G	1445	15.6	--	--	145	--	--	--	--	1,700,000	1,700,000	"
6/30/64 to 7/1/64	C	1115 1115	--	7.6	--	58	2,460	276	226	6.0	--	--	0.65
7/1/64 to 7/2/64	C	1300 1000	--	--	--	285	--	332	276	--	--	--	0.65

B) Lagoon effluent

Dates of Sampling	Type of Sample	Time	Temp °C	pH	Diss. Oxygen mg/1	BOD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Total Coliform MPN/100ml	Fecal Coliform MPN/100ml	Flow MGD
6/30/64	G	1405	27.5	--	0.0	--	--	--	--	--	1,700,000	1,700,000	0.49
6/30/64	G	1445	--	--	--	165	--	--	--	--	2,300,000	2,300,000	"
9/15/64	G	0855	15.0	--	--	248	--	298	296	<0.1	--	--	"
9/15/64	G	1210	16.5	--	--	235	--	370	336	<0.1	--	--	"
9/16/64	G	0920	16.0	--	--	192	--	295	275	<0.1	--	--	"
9/16/64	G	1300	18.0	--	--	238	--	276	272	<0.1	--	--	"
6/30/64 to 7/1/64	C	1130 1100	--	7.7	--	180	--	252	250	0.2	--	--	0.49
9/15/64 to 9/16/64	C	0915 0915	--	--	--	190	--	310	310	<0.1	--	--	0.49

GATES RUBBER COMPANY
999 South Broadway
Denver, Colorado

Date of Visit: October 8, 1964

Persons Contacted: Carl Metcalf, Project Engineer
Robert Carlson, Plant Utilities Department
Clarence Hester, Superintendent, Reclaim Rubber Department
Robert Motazedi, Chemist, Reclaim Rubber Department

Process and Operation: The Gates Rubber Company in 1961 was the sixth largest rubber manufacturer in the country and also the largest manufacturer across the world of V-belts for industry. The Company's products are widely distributed in the United States and exports are shipped to more than 90 foreign countries. In addition to the Denver operations, the Gates Rubber Company maintains manufacturing plants at Nashville, Tennessee; Galesburg, Illinois; Sioux City, Iowa; Wichita, Kansas; and Chicago, Illinois.

The Denver installation manufactures four main lines of products as follows:

1. V-belts, automotive fan-belts, light-duty belts for home, farm and commercial use, and heavy-duty belts for industry.

2. Hoses. Radiator and car-heater hoses, rubber and plastic hoses for home, farm, commercial and industrial use.

3. Tires. Passenger and truck tires, inner tubes, tread rubber for tire-recapping, and repair materials.

4. Mechanical rubber goods. Various types including lawnmower tires, rubber parts on milking machines, rubber lining for tank cars. and rubber gate seals for power dams.

Principal raw materials for plant operation comprise natural, synthetic, and reclaimed rubber; rayon, nylon, dacron and cotton; 50 percent carbon black, zinc stearate, zinc oxide, sulfur powder, soapstone powder, xylene, and toluene.

The Denver plant maintains operation 24 hours a day, 6 days each week. The employee breakdown was given as follows: factory - 3318, office and engineers - 1500, medical staff - 77, and warehouse area - 508, for a total of 5403 persons.

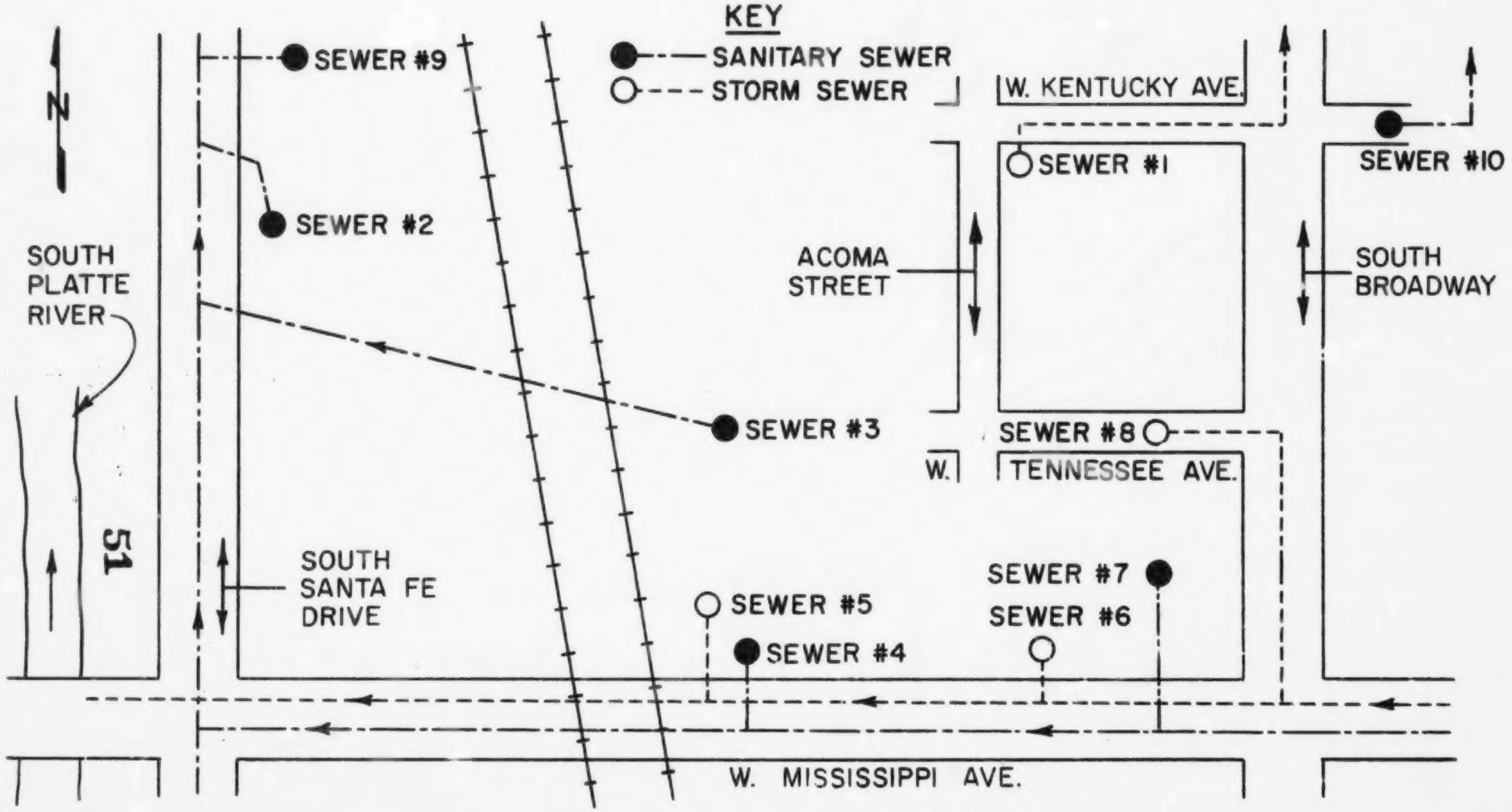
Sources and Uses of Water: Plant water is supplied by the City of Denver and by three company wells each 42 feet in depth. Water consumption approximates 18.1 million gallons per week in the summertime of which 11.8 is obtained from Denver, and 13.5 million gallons per week during the winter of which 8.2 is obtained from Denver. Of this water, an average of 2.5 MGD is returned to the sewers for operational days during the summer, and lesser amounts in the winter. It was also reported that 11.5 MGD of water are continuously recirculated through the cooling towers. Once a month, HTH and an algicide are added to these cooling waters. Sludge is removed from the cooling tower sumps every 4 to 5 months.

Sources and Characteristics of Wastes: Various process wastes originate from the manufacture of rubber products. Some of these wastes are high in organic material or solids, or both. The wastewater from the rubber reclaim department is strongly alkaline and also contains high concentrations of organic matter and solids. Certain wastewater streams contain significant quantities of oil. Spent cooling waters represent a large volume of wastewater but are relatively low in organic and solids content.

Treatment and Disposal of Wastes: The Gates Rubber Company discharges its wastewater and domestic sewage through a total of ten connections to various sanitary and storm sewers in the area of the plant as shown by Appendix B - Figure 2. Plant sewers numbers 2, 3, 4, 7, 9, and 10 flow into the City of Denver sanitary sewers located under South Santa Fe Drive, West Mississippi Avenue, and West Arizona Avenue. Plant sewers numbers 5, 6, and 8 connected to the West Mississippi Avenue storm drain and plant sewer number 1 connected to the West Kentucky Avenue storm drain are considered of paramount importance to this study since both of these storm drains or sewers discharge directly into the South Platte River. Company personnel estimated that approximately 1.8 MGD wastewater are released to the Denver sanitary sewers. The remaining plant wastes approximating 0.8 MGD are released to the two storm sewers; of which 0.79 MGD are directed to the Mississippi Avenue drain, and 0.01 MGD to the West Kentucky Avenue drain.

Oil sumps are located at strategic points within the plant to recover oil before reaching the sewers. These sumps receive inspection and clean-out at regular intervals.

GATES RUBBER COMPANY
DENVER, COLORADO
STORM AND SANITARY SEWER CONNECTIONS


KEY
● — - — SANITARY SEWER
○ - - - STORM SEWER
N
SEWER #9
SEWER #2
SOUTH PLATTE RIVER
SEWER #3
SOUTH SANTA FE DRIVE
SEWER #5
SEWER #4
W. KENTUCKY AVE.
SEWER #1
ACOMA STREET
SEWER #8
W. TENNESSEE AVE.
SEWER #7
SEWER #6
SEWER #10
SOUTH BROADWAY
W. MISSISSIPPI AVE.

APPENDIX B
FIGURE 2

APPENDIX B - TABLE XIX

GATES RUBBER COMPANY
DENVER, COLORADO
SAMPLING RESULTS

Sewer No. 1 sampled at manhole directly east of Acoma Street, Kentucky Avenue Company gate and inside Company fence-line, before discharge to West Kentucky Avenue storm sewer

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Oil mg/1	Flow MGD
2/1/65	G	1045	10	7.9	5	--	424	35	20	<0.1	--	0.02
2/1/65	G	1500	6.0	7.7	20	--	655	314	53	<0.1	--	"
2/2/65	G	0835	14	8.0	76	--	647	54	45	<0.1	--	"
2/2/65	G	1505	7.0	7.6	44	--	464	150	42	<0.1	--	"
2/3/65	G	0900	15.0	7.8	17	--	707	46	40	<0.1	--	"
2/3/65	G	1550	13.0	8.5	28	--	651	112	44	<0.1	--	"
2/1/65 to 2/2/65	C	0930 0930	--	7.6	24	52	590	49	20	<0.1	( )a/ ( )	0.02
2/2/65 to 2/3/65	C	0945 0945	--	7.8	17	--	565	20	11	<0.1	(3.0) ( )	0.02
2/3/65 to 2/4/65	C	0945 0945	--	8.2	11	56	670	26	20	<0.1	( ) ( )	0.02

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a/ The numerical value represents a composite of the 3 composite samples.

APPENDIX B - TABLE XX

GATES RUBBER COMPANY
DENVER, COLORADO
SAMPLING RESULTS

Sewer No. 5 sampled at manhole directly east of railroad approximately 10 feet north of Company fence-line and inside Company gate, before discharge to West Mississippi Avenue storm sewer

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Oil mg/1	Flow MGD
2/1/65	G	1000	32.0	7.6	14	--	424	42	25	<0.1	--	0.70
2/1/65	G	1340	30.0	7.8	18	--	371	39	28	0.1	--	"
2/2/65	G	0820	31.0	8.0	12	--	397	5	5	<0.1	--	"
2/2/65	G	1450	31.0	7.9	12	--	474	21	16	<0.1	--	"
2/3/65	G	0845	31.0	8.0	11	--	434	39	22	<0.1	--	"
2/3/65	G	1540	30.0	7.9	16	--	411	98	70	0.1	--	"
2/1/65 to 2/2/65	C	0930 0930	--	7.8	31	35	434	16	12	<0.1	( )a/ ( )	0.70
2/2/65 to 2/3/65	C	0930 0930	--	7.8	12	--	452	34	27	<0.1	(14) ( )	0.70
2/3/65 to 2/4/65	C	0930 0930	--	7.5	5	22	484	14	10	<0.1	( ) ( )	0.70

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a/ The numerical value represents a composite of the 3 composite samples.

APPENDIX B - TABLE XXI

GATES RUBBER COMPANY
DENVER, COLORADO
SAMPLING RESULTS

Sewer No. 6 sampled at manhole approximately 150 feet east of railroad and 15 feet north of Company fence-line before discharge to West Mississippi Avenue storm sewer

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/l	COD mg/l	Cond. umhos	TSS mg/l	VSS mg/l	Settl. Sol. ml/l	Oil mg/l	Flow MGD
2/1/65	G	1010	16.0	7.6	83	--	478	79	42	0.1	--	0.02
2/1/65	G	1345	17.0	7.4	86	--	432	63	58	<0.1	--	"
2/2/65	G	0815	15.0	8.0	205	--	442	95	68	<0.1	--	"
2/2/65	G	1435	19.0	7.8	>340	--	515	56	42	<0.1	--	"
2/3/65	G	0840	19.0	8.1	2	--	610	64	45	<0.1	--	"
2/3/65	G	1530	17.0	8.3	>340	--	531	156	108	<0.1	--	"
2/1/65 to 2/2/65	C	0940 0940	--	7.8	140	223	414	54	46	<0.1	( )[a] ( )	0.02
2/2/65 to 2/3/65	C	0940 0940	--	7.6	210	--	471	44	34	<0.1	(26) ( )	0.02
2/3/65 to 2/4/65	C	0940 0940	--	7.6	330	--	455	90	75	<0.1	( ) ( )	0.02

---

[a] The numerical value represents a composite of the 3 composite samples.

APPENDIX B - TABLE XXII

GATES RUBBER COMPANY
DENVER, COLORADO
SAMPLING RESULTS

Sewer No. 8 sampled at manhole on West Tennessee Avenue and 15 feet north of time-card building, before discharge to West Mississippi Avenue storm sewer.

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Oil mg/1	Flow MGD
2/1/65	G	1025	28.0	7.9	49	--	528	138	132	<0.1	--	0.02
2/1/65	G	1355	24.0	8.0	15	--	593	35	33	<0.1	--	"
2/2/65	G	0825	29.0	8.0	17	--	451	22	18	<0.1	--	"
2/2/65	G	1500	25.0	8.2	16	--	1620	34	24	<0.1	--	"
2/3/65	G	0855	25.0	8.1	42	--	610	31	22	<0.1	--	"
2/3/65	G	1545	23.0	7.2	17	--	762	30	18	<0.1	--	"
2/1/65 to 2/2/65	C	0920 0920	--	7.6	26	66	577	21	18	<0.1	( )[a] ( )	0.02
2/2/65 to 2/3/65	C	0920 0920	--	7.2	22	65	1230	43	28	<0.1	(8.0) ( )	0.02
2/3/65 to 2/4/65	C	0920 0920	--	7.4	62	77	568	29	25	<0.1	( ) ( )	0.02

---

[a] The numerical value represents a composite of the 3 composite samples.

GENERAL CHEMICAL DIVISION
ALLIED CHEMICAL CORPORATION
1271 West Bayaud Avenue
Denver, Colorado

Date of Visit: March 31, 1964

Persons Contacted: J. P. Morgan, Plant Manager
Joseph Kowan, Chief Chemist
Clinton R. Walbridge, Specialist

Process and Operation: The Denver plant of General Chemical Division, Allied Chemical Corporation, manufactures sulfuric acid by roasting of pyrites followed by the Contact Process. Aluminum sulfate is a secondary product of the plant operations. Pyrite cinders, which are a mixture of the ferric oxide remaining from the burner and the sludge from the cone settler on the gas cooling tower represent an important by-product used by a local cement-mix company in production of cinder blocks. The chief raw materials necessary to the General Chemical Division plant are iron pyrites (approximately 50 percent sulfur) and aluminum hydrate. Actual plant capacity and production were not disclosed. A flow diagram showing production and associated waste flows is given by Appendix B - Figure 3.

The Company maintains operation 24 hours a day, 7 days a week utilizing 44 full-time employees. Shutdowns of certain parts of the plant for necessary maintenance are scheduled so as to minimize down-time and conserve heat-capacity within the process.

Sources and Uses of Water: Plant water supply is received from three sources. These include the South Platte River, the City of Denver water system, and a seepage inflow pond located on the Company property. The River water intake ranges from 5 to 9 million gallons per month, the City of Denver supply around one million gallons per month, and the pond water is used only during times when the pumps for the River water supply are inoperative.

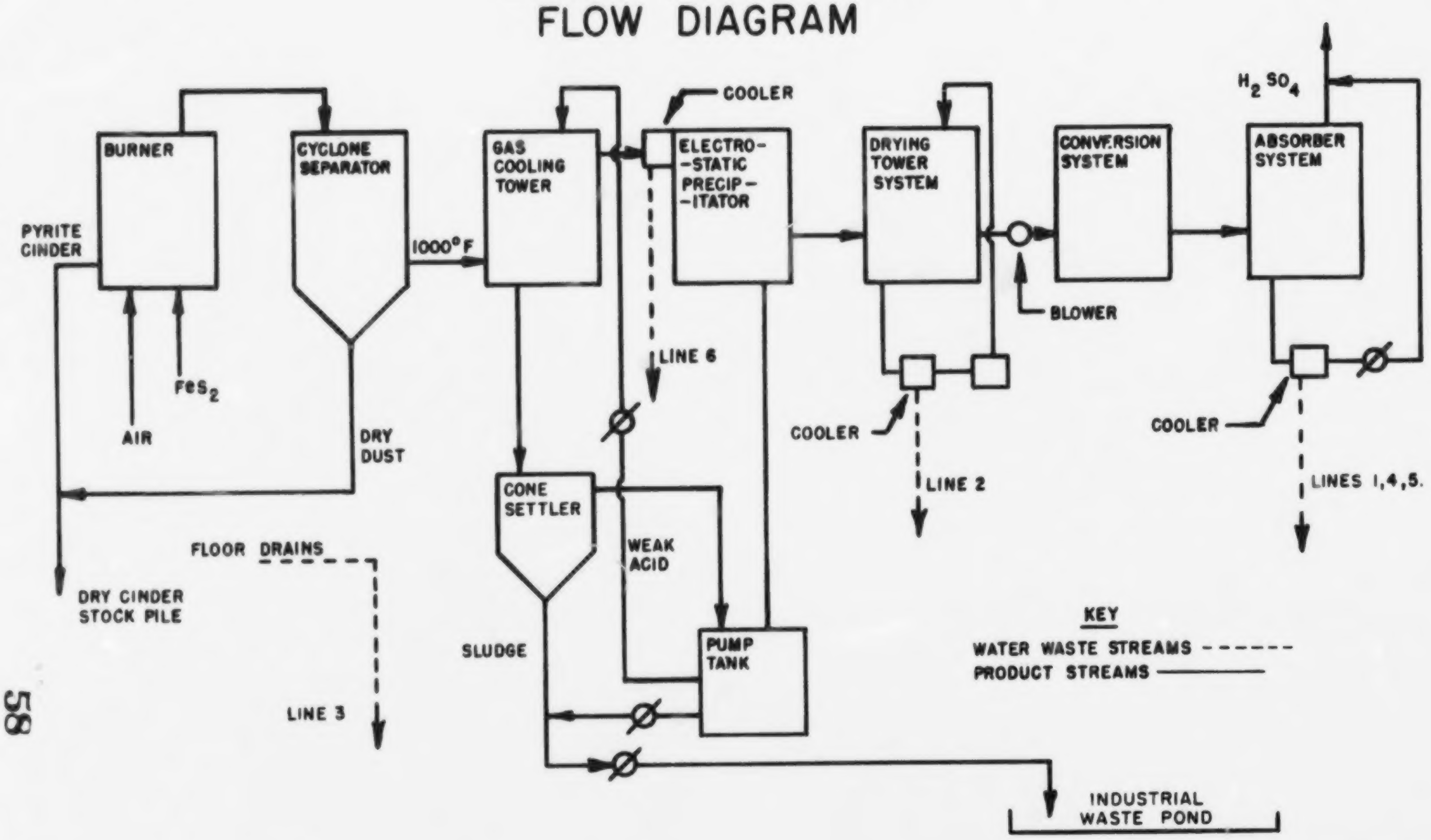
Sources and Characteristics of Wastes: Condensates from the gas cooler and liquid wastes from the cone settler on the gas cooling tower appear to be the two strongest wastes from process operations. The large majority of water is used within the plant for cooling purposes and consequently spent coolant waters represent the major part of wastes discharged. The Company reported that the spent coolant waters as compared to inflow reflected on the average a 6° C rise in temperature and a decrease of one-half unit in pH value.

Treatment and Disposal of Wastes: Liquid wastes from the cone settler on the gas cooling tower together with condensates from the gas cooler are released to an industrial wastepond on the plant property from which there is no reported overflow.

Spent cooling waters and minor miscellaneous flows are released to the South Platte River by means of six separate discharge lines which are described as follows in the downstream River direction: 1) absorbing acid cooling water; 2) drying acid cooling water; 3) floor drainage; 4) oleum cooling water; 5) dry acid absorbing cooling water and; 6) downdraft cooling water.

At the time of plant sampling in January 1965, no waste flow and therefore no waste load was observed for Line 3 leading to the South Platte River. Based upon this observation and certain data collected by the Colorado Department of Public Health in 1963, a preliminary recommendation is made herein that continuous monitoring of the quality of these six waste effluents should be established and maintained for an indefinite period in the future.

GENERAL CHEMICAL DIVISION
DENVER, COLORADO
FLOW DIAGRAM


PYRITE CINDER
BURNER
AIR
FeS_2
CYCLONE SEPARATOR
DRY DUST
DRY CINDER STOCK PILE
FLOOR DRAINS
LINE 3
1000°F
GAS COOLING TOWER
COOLER
ELECTRO--STATIC PRECIP--ITATOR
LINE 6
CONE SETTLER
WEAK ACID
SLUDGE
PUMP TANK
DRYING TOWER SYSTEM
COOLER
LINE 2
BLOWER
CONVERSION SYSTEM
ABSORBER SYSTEM
H_2SO_4
COOLER
LINES 1,4,5.
KEY
WATER WASTE STREAMS - - - - - -
PRODUCT STREAMS ———
INDUSTRIAL WASTE POND

APPENDIX B
FIGURE 3

APPENDIX B - TABLE XXIII

GENERAL CHEMICAL DIVISION
ALLIED CHEMICAL CORPORATION
DENVER, COLORADO
SAMPLING RESULTS

South Platte River water intake to plant sampled at intake box

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Total Solids mg/1	Vol. Tot. Solids mg/1	Settl. Sol. ml/1
1/18/65 to 1/19/65	C	--	--	8.0	16	25	905	12	9	--	--	<0.1
1/19/65 to 1/20/65	C	--	--	8.2	7	12	953	17	7	612	--	<0.1
1/20/65 to 1/21/65	C	--	--	8.0	3	29	1010	23	12	597	193	<0.1
1/21/65 to 1/22/65	C	--	--	8.0	8	26	930	26	9	641	195	<0.1

Tot. Alk. as $CaCO_3$ mg/1	Total Iron mg/1	SO_4 mg/1	ABS mg/1	Flow MGD
--	0.62	196	1.9	2.23
264	0.70	179	1.8	2.23
234	0.88	229	1.7	2.23
252	1.09	--	1.8	2.23

APPENDIX B - TABLE XXIV

GENERAL CHEMICAL DIVISION
ALLIED CHEMICAL CORPORATION
DENVER, COLORADO
SAMPLING RESULTS

Line 1 - Absorbing acid cooling water effluent to South Platte River

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Total Solids mg/1	Settl. Sol. ml/1	Tot. Alk. as $CaCO_3$ mg/1	Total Iron mg/1	SO_4 mg/1	ABS mg/1	Flow MGD
1/18/65	G	1012	20.0	8.2	9	16	967	15	6	--	<0.1	--	--	195	--	0.84
1/18/65	G	1306	18.0	8.0	--	20	1010	26	14	--	<0.1	--	--	144	--	"
1/19/65	G	0800	16.0	7.8	--	18	963	36	8	--	0.1	--	--	222	--	"
1/19/65	G	1305	17.0	7.8	18	15	895	24	10	--	<0.1	--	--	169	--	"
1/20/65	G	0940	16.0	8.0	10	--	950	50	12	--	0.1	--	--	174	--	"
1/20/65	G	1335	17.0	7.8	7	--	935	32	16	--	<0.1	--	--	236	--	"
1/18/65 to 1/19/65	C	1000 1000	--	8.0	10	20	954	24	4	--	<0.1	--	0.62	196	1.9	0.84
1/19/65 to 1/20/65	C	1000 1000	--	8.0	7	31	935	15	6	613	<0.1	244	0.72	163	1.8	0.84

APPENDIX B - TABLE XXV

GENERAL CHEMICAL DIVISION
ALLIED CHEMICAL CORPORATION
DENVER, COLORADO
SAMPLING RESULTS

Line 2 - Drying acid cooling water effluent to South Platte River

Dates of Sampling	Type of Sample	Time	Temp ^{o}C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Total Solids mg/1	Vol. Tot. Solids mg/1	Settl. Sol. ml/1
1/20/65	G	0940	6.0	8.0	10	--	860	24	8	--	--	<0.1
1/20/65	G	1332	7.0	7.6	6	--	854	30	12	--	--	<0.1
1/21/65	G	0805	5.0	8.0	6	--	923	27	13	--	--	<0.1
1/21/65	G	1415	16.0	8.2	7	--	815	32	12	--	--	<0.1
1/22/65	G	0825	14.0	8.1	--	--	923	23	7	--	--	<0.1
1/22/65	G	1100	15.0	8.2	8	--	954	22	6	--	--	<0.1
1/19/65 to 1/20/65	C	1000 1000	--	8.2	6	20	970	18	8	--	--	<0.1
1/20/65 to 1/21/65	C	1000 1000	--	7.9	7	28	998	22	11	587	145	<0.1
1/21/65 to 1/22/65	C	1000 1000	--	8.1	8	26	900	17	5	581	190	<0.1

Tot. Alk. as $CaCO_3$ mg/1	Total Iron mg/1	SO_4 mg/1	ABS mg/1	Flow MGD
--	--	143	--	0.49
--	--	219	--	"
--	--	139	--	"
--	--	173	--	"
--	--	--	--	"
--	--	--	--	"
248	0.69	238	2.0	0.49
222	0.98	93	1.7	0.49
252	0.86	--	1.8	0.49

APPENDIX B - TABLE XXVI

GENERAL CHEMICAL DIVISION
ALLIED CHEMICAL CORPORATION
DENVER, COLORADO
SAMPLING RESULTS

Line 4 - Oleum cooling water effluent to South Platte River

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Total Solids mg/1	Vol. Tot. Solids mg/1	Settl. Sol. ml/1
1/18/65	G	1008	14.0	8.9	10	36	934	163	23	--	--	0.5
1/18/65	G	1303	19.0	8.1	12	31	1010	34	14	--	--	0.2
1/19/65	G	0755	12.0	7.9	14	26	865	94	14	--	--	0.3
1/19/65	G	1307	13.0	8.0	40	20	860	26	10	--	--	<0.1
1/20/65	G	0943	10.0	8.1	8	--	825	46	17	--	--	0.1
1/20/65	G	1338	11.0	8.0	7	--	834	53	16	--	--	0.1
1/19/65 to 1/20/65	C	1000 1000	--	8.0	7	10	796	16	6	544	--	<0.1
1/20/65 to 1/21/65	C	1000 1000	--	8.0	5	33	908	22	12	523	135	<0.1

Tot. Alk. as $CaCO_3$ mg/1	Total Iron mg/1	SO_4 mg/1	ABS mg/1	Flow MGD
--	--	168	--	0.03
--	--	203	--	"
--	--	195	--	"
--	--	151	--	"
--	--	154	--	"
--	--	250	--	"
164	0.72	160	1.6	0.03
228	0.95	208	1.4	0.03

APPENDIX B - TABLE XXVII

GENERAL CHEMICAL DIVISION
ALLIED CHEMICAL CORPORATION
DENVER, COLORADO
SAMPLING RESULTS

Line 5 - Dry acid absorbing cooling water effluent to South Platte River

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Total Solids mg/1	Vol. Tot. Solids mg/1	Settl. Sol. ml/1	Tot. Alk. as $CaCO_3$ mg/1	Total Iron mg/1	SO_4 mg/1	ABS mg/1	Flow MGD
1/18/65	G	1000	22.0	7.6	15	20	1000	11	5	--	--	<0.1	--	--	168	--	0.26
1/18/65	G	1300	20.0	8.0	12	16	1000	23	13	--	--	<0.1	--	--	207	--	"
1/19/65	G	0755	17.0	7.9	--	16	968	20	6	--	--	<0.1	--	--	200	--	"
1/19/65	G	1310	19.0	8.0	12	16	1040	25	12	--	--	<0.1	--	--	168	--	"
1/20/65	G	0937	18.0	8.1	8	--	943	25	8	--	--	<0.1	--	--	163	--	"
1/20/65	G	1340	20.0	8.1	8	--	953	30	13	--	--	<0.1	--	--	--	--	"
1/18/65 to 1/19/65	C	1000 1000	--	8.1	16	39	910	13	5	--	--	<0.1	--	0.45	190	2.0	0.26
1/21/65 to 1/22/65	C	1000 1000	--	8.0	15	30	912	17	5	594	166	<0.1	252	0.83	--	1.7	0.26

APPENDIX B - TABLE XXVIII

GENERAL CHEMICAL DIVISION
ALLIED CHEMICAL CORPORATION
DENVER, COLORADO
SAMPLING RESULTS

Line 6 - Downdraft cooling water effluent to South Platte River

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Total Solids mg/1	Vol. Tot. Solids mg/1	Settl. Sol. ml/1	Tot. Alk. as $CaCO_3$ mg/1	Total Iron mg/1	Al mg/1	SO_4 mg/1	ABS mg/1	Flow MGD
1/20/65	G	0940	18.0	8.2	9	--	910	40	10	--	--	<0.1	--	--	--	168	--	0.29
1/20/65	G	1320	24.0	8.2	11	--	953	34	11	--	--	<0.1	--	--	--	226	--	"
1/21/65	G	0810	18.5	8.2	11	--	975	32	10	--	--	<0.1	--	--	--	182	--	"
1/21/65	G	1410	21.0	8.2	14	--	1000	28	28	--	--	<0.1	--	--	--	196	--	"
1/22/65	G	0825	21.0	8.2	20	--	840	36	7	--	--	<0.1	--	--	--	--	--	"
1/22/65	G	1100	21.0	8.2	18	--	872	22	6	--	--	<0.1	--	--	--	--	--	"
1/20/65 to 1/21/65	C	1000 1000	--	8.1	8	29	1010	22	9	598	155	<0.1	228	0.63	0.13	143	1.8	0.29
1/21/65 to 1/22/65	C	1000 1000	--	8.0	18	48	935	23	7	592	151	<0.1	256	1.08	0.14	--	1.3	0.29

KUNER EMPSON COMPANY
Brighton, Colorado

Date of Visit: May 6, 1964

Persons Contacted: William C. Kunzman, Production Manager
Richard A. Lofgren, Superintendent

Process and Operation: The Brighton establishment of the Kuner Empson Company is a vegetable cannery handling green and wax beans, cucumbers (pickles), peppers, and cabbage (sauerkraut). Various amounts of salts, sugar, spices, alum etc. are used as essential ingredients depending upon the final product desired. The operations may be classed as seasonal although certain activities are conducted on a year-around basis. Much of the same equipment is more or less adaptable and used in canning of various products. The canning schedule at the Brighton plant is approximately as follows:

Fresh-pack pickles:	July 1 to September 1
Green and wax beans:	July 15 to September 15
Peppers and sauerkraut (preparation):	September 1 to October 1
Cured pickles:	September 1 to July 1 (the following year)
Sauerkraut (canning):	October 1 to March 15 (the following year)

Basic process operations consist of 1) removing extraneous and nonedible matter in preparatory steps such as grading, snipping, cutting, trimming, and then washing and/or soaking; 2) blanching, shredding, further soaking, and fermenting; and 3) filling and sealing of cans, cooking, retorting, cooling, and storage.

The heavy canning period extends from July 1 to about October 1 on a 8 to 12 hour daily schedule. The number of employees totals about 300 persons from mid-summer to early fall and considerably less during the remainder of the year.

Sources and Uses of Water: Plant water supply is obtained from four Company wells and also from the City of Brighton. Three of the wells are 20 feet deep with a combined capacity of 300 gallons per minute and the fourth is 30 feet deep with a capacity of 90 gallons per minute.

Process water requirements are shown as follows:

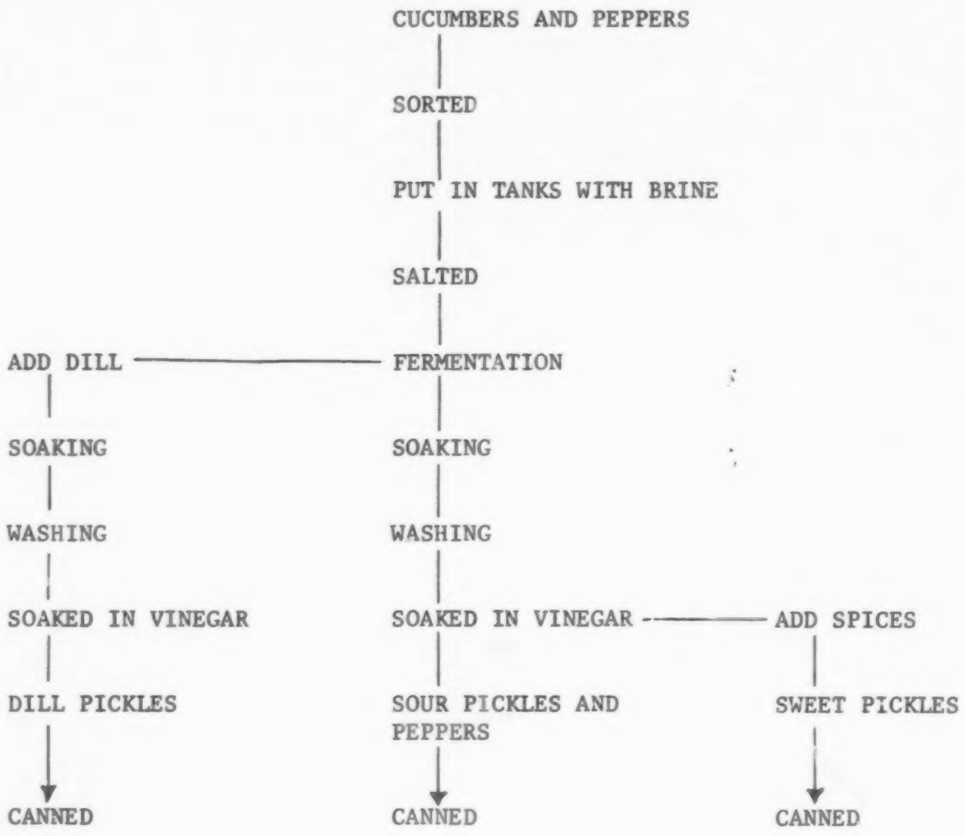
Product	Operation	Length of Season-Days	Million Gallons Water Necessary During Season
Green and Wax Beans	Canning	40	0.5 blanching 7.0 retorting also 2,000 gallons per hour for fluming and washing
Sauerkraut	Cutting	15	Small amounts
	Curing	5½ months	0.13
	Canning	5½ months	2.0
Pickles (Fresh-pack)	Washing	2 months	0.22
	Pasteurizing	"	0.24
	Brining	"	0.17

Sources and Characteristics of Wastes: Major plant wastes originate from fluming, trimming, washing, curing, cooking and canning operations. Liquid wastes are high in organic matter, coarse and dissolved solids, and color. Domestic wastes and process liquors from the pickle canning operations are released to the City of Brighton sanitary sewers. These pickle canning liquors over the season reportedly amount to 3.9 million gallons. Fluming waters are recirculated to an unknown extent within the plant; spent flume waters containing dirt and fine organic material are screened prior to discharge into a small pond which then over-flows to McCann Canal.

Treatment and Disposal of Wastes: The disposition of domestic wastes, pickle canning process waters and flume waters were described in the foregoing paragraph. The brine vats after use are dumped and the resulting liquors are eventually disposed of by ground seepage. The total volume of this brine over the season was reported as 0.17 million gallons. Remaining plant wastes are discharged either to the McCann Canal or directly into the South Platte River at River Mile 295.9. Available data from the Company shows that seasonal wastes from the overall bean canning operations approximates 7.5 million gallons whereas that from sauerkraut canning is in the area of 2.1 million gallons. The Brighton plant of the Kuner Empson Company is in a similar position to the Longmont plant of the same Company, with little or no treatment provided for wastes reaching the receiving streams. In view of the seriousness of the overall stream pollution picture in the South Platte River Basin, the Kuner Empson Company should reappraise its position on waste abatement and treatment.

KUNER EMPSON COMPANY
BRIGHTON, COLORADO

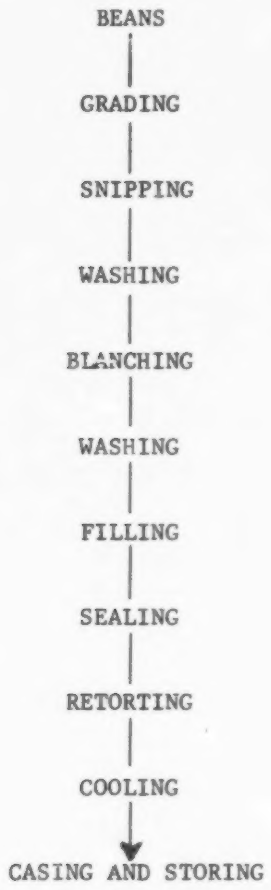
PROCESS LINE DIAGRAM FOR PEPPER AND PICKLE CANNING


CUCUMBERS AND PEPPERS
SORTED
PUT IN TANKS WITH BRINE
SALTED
ADD DILL
FERMENTATION
SOAKING
SOAKING
WASHING
WASHING
SOAKED IN VINEGAR
SOAKED IN VINEGAR
ADD SPICES
DILL PICKLES
SOUR PICKLES AND PEPPERS
SWEET PICKLES
CANNED
CANNED
CANNED

APPENDIX B
FIGURE 4

KUNER EMPSON COMPANY
BRIGHTON, COLORADO

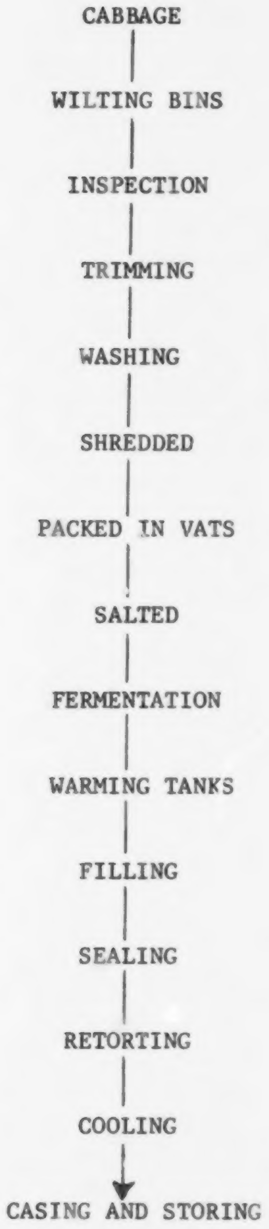
PROCESS LINE DIAGRAM FOR GREEN AND WAX BEAN CANNING


BEANS
GRADING
SNIPPING
WASHING
BLANCHING
WASHING
FILLING
SEALING
RETORTING
COOLING
CASING AND STORING

APPENDIX B
FIGURE 5

KUNER EMPSON COMPANY
BRIGHTON, COLORADO

PROCESS LINE DIAGRAM FOR SAUERKRAUT CANNING


CABBAGE
WILTING BINS
INSPECTION
TRIMMING
WASHING
SHREDDED
PACKED IN VATS
SALTED
FERMENTATION
WARMING TANKS
FILLING
SEALING
RETORTING
COOLING
CASING AND STORING

APPENDIX B
FIGURE 6

APPENDIX B - TABLE XXIX

KUNER EMPSON COMPANY
BRIGHTON, COLORADO
SAMPLING RESULTS

Drainage from kraut-house entering McCann Canal on south side of cabbage-house; waste sampled at beginning of open ditch after discharge of closed pipe flow into this ditch

Dates of Sampling	Type of Sample	Time	Temp °C	BOD mg/1	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Chlorides mg/1	Flow MGD
9/14/64	G	1355	16.0	--	71	37	0.3	--	0.05
9/14/64	G	1500	15.5	18	327	60	1.3	--	"
9/15/64	G	0750	14.5	--	37	13	<0.1	--	"
9/15/64	G	1130	15.5	--	46	24	0.1	--	"
9/15/64	G	1405	15.0	10	38	18	<0.1	--	"
9/16/64	G	0800	15.0	--	76	12	<0.1	--	"
9/16/64	G	1025	16.0	--	196	46	1.0	--	"
9/16/64	G	1320	15.0	13	151	49	0.3	--	"
9/14/64 to 9/15/64	C	1400 1400	--	--	119	66	0.2	295	0.05
9/15/64 to 9/16/64	C	1400 1400	--	18	120	37	0.4	285	0.05
9/16/64 to 9/17/64	C	1400 1400	--	--	138	136	--	326	0.05

APPENDIX B - TABLE XXX

KUNER EMPSON COMPANY
BRIGHTON, COLORADO
SAMPLING RESULTS

Discharge from main plant crossing under cabbage-house and entering South Platte River; waste sampled at beginning of wooden flume after release of closed pipe flow into the flume

Dates of Sampling	Type of Sample	Time	Temp °C	BOD mg/1	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Chlorides mg/1	Flow MGD
9/14/64	G	1345	39.0	128	50	50	0.5	--	0.26
9/14/64	G	1502	39.0	200	78	78	1.5	--	"
9/15/64	G	0755	18.0	21	--	--	<0.1	--	"
9/15/64	G	1135	31.5	>255	73	72	3.0	--	"
9/15/64	G	1350	33.5	>258	138	138	1.0	--	"
9/16/64	G	0810	23.0	8	11	8	<0.1	--	"
9/16/64	G	1030	31.0	95	35	35	0.1	--	"
9/16/64	G	1330	26.0	95	162	104	1.0	--	"
9/14/64 to 9/15/64	C	1200 1200	--	208	136	126	1.5	238	0.26
9/15/64 to 9/16/64	C	1420 1420	--	>238	252	190	1.0	290	0.26
9/16/64 to 9/17/64	C	1420 1000	--	143	132	126	--	232	0.26

APPENDIX B - TABLE XXXI

KUNER EMPSON COMPANY
BRIGHTON, COLORADO
SAMPLING RESULTS

Waste effluent originating from pickle bins for ground seepage; sampled at end of pipe before discharge into open ditch

Dates of Sampling	Type of Sample	Time	Temp °C	BOD mg/1	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Chlorides mg/1	Flow MGD
9/15/64	G	0805	14.0	>263	112	84	<0.1	--	0.01
9/15/64	G	1150	16.0	>245	434	418	0.1	--	"
9/15/64	G	1335	15.5	>281	3,600	1,080	32.0	11,400	"
9/16/64	G	0815	13.0	>286	190	156	<0.1	--	"
9/16/64	G	1035	16.0	>288	174	138	0.4	--	"
9/16/64	G	1500	19.5	> 240	945	295	5.0	4,300	"
9/17/64	G	1050	17.0	140	30	24	<0.1	--	"
9/17/64	G	1430	20.0	135	32	28	--	1,180	"

LITVAK MEAT COMPANY
(INCLUDES STOVALL BY-PRODUCTS)
5900 York Street
Adams County, Colorado

Date of Visit: June 19, 1964

Persons Contacted: Leonard L. Litvak, President
Ed Walt, Chief Engineer
Matt Gillman

Process and Operation: The Litvak Meat Company conducts packinghouse operations with dressing-out of cattle carcasses. The plant receives and handles an average of 250 cattle per day. Stovall By-Products which is located adjoining the Litvak Meat Company is a rendering division of the parent Company. Major output includes dressed-out carcasses and various by-products from the renderable materials. The packinghouse operates from 7 AM to 3 PM daily and the rendering division from 10 AM to 6 PM daily. The plant utilizes the services of between 85 and 100 persons who work on the average of 5 and one-half days per week, 8 hours per day.

Sources and Uses of Water: Plant water supply is received from three wells. Two of these wells are 600 feet deep and with a combined capacity of 115 gallons per minute provide supply for processing, boiler-feed makeup, cooling water, and domestic needs. This supply is chlorinated prior to use. The third well is 40 feet deep and with a capacity of 200 gallons per minute provides for floor and equipment washing and supply for the rendering cookers. Additionally, the Company has an arrangement with the North Washington Water and Sanitation District for emergency-use water.

Sources and Characteristics of Wastes: The processing effluents from the Litvak Meat Company are representative of wastes produced from a packinghouse operation with its own rendering facilities. Blood, meat scraps, and bone are salvaged as necessary raw material for the rendering division. The liquid wastes leaving the packinghouse are pre-treated and entirely discharged to the North Washington Water and Sanitation District. The paunch manure retained in these wastes may impose undue treatment and disposal problems to the District. The Litvak Meat Company contributes a sizable waste load to the South Platte River by virtue of discharging all excess cooling water and cooker condensates from the rendering operations to the receiving stream. No treatment is provided for these wastes which are characterized by high levels of dissolved organic material and grease content.

Treatment and Disposal of Wastes: Liquid wastes from the rendering plant are disposed of directly and without treatment to the South Platte River. Packinghouse wastes flow into a settling tank which is 30 by 6 feet by

10 feet deep. A mechanical top-skimming device collects grease from the tank which is then transported to the rendering cookers. Settleable solids are discharged to a sump and the liquid body in the settling tank is discarded to the North Washington Water and Sanitation District sewers. The settleable solids enter the sump together with paunch manure from processing. These solids are subsequently passed through a 20-mesh vibrating screen. The material retained on the screen is sold to a local fertilizer company or given to adjoining farmers, whereas the screened liquors are released to the Sanitation District sewers.

Lastly, the cattle feedlot pens of the Litvak Meat Company produce manure and spent livestock drinking water. The manure from the pens is disposed of to local farmers, and the excess yard water or drainage reportedly is discharged to the North Washington Water and Sanitation District sewers.

APPENDIX B - TABLE XXXII

LITVAK MEAT COMPANY
ADAMS COUNTY, COLORADO
SAMPLING RESULTS

A) Discharge from 18-inch outfall to South Platte River 500 yards north of York Street

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Total Coliform MPN/100ml	Fecal Coliform MPN/100ml	Grease mg/1	Flow MGD
1/27/66	G	1030	38	7.0	105	282	2700	--	--	0.3	130,000	79,000	--	0.04
2/1/66	G	0600	20	7.0	545	1020	1390	748	705	1.4	7,000,000	4,900,000	625	"
2/1/66	G	0900	20	7.4	70	245	1480	64	53	<0.1	330,000	130,000	40	"
2/1/66	G	1100	21	7.6	31	235	1400	32	18	<0.1	490,000	170,000	18	"
2/1/66	G	1300	19	6.9	50	208	1510	195	88	<0.1	490,000	330,000	53	"
2/1/66	G	1500	18	7.7	89	226	2160	49	34	<0.1	230,000	230,000	12	"
2/1/66	G	1700	19	7.8	24	136	1300	20	13	<0.1	170,000	130,000	9	"
2/1/66	G	1900	20	6.9	19	55	1410	13	12	<0.1	170,000	79,000	7	"
2/1/66	G	2100	18	7.5	20	152	1250	15	15	<0.1	130,000	130,000	105	"
2/1/66	G	2300	18	7.7	23	146	1240	19	18	<0.1	230,000	230,000	170	"
2/2/66	G	0200	16	7.4	25	87	1480	13	10	<0.1	33,000	11,000	<1	"
2/2/66	G	0400	16	7.5	20	87	1360	46	40	<0.1	230,000	33,000	7	"
2/2/66	G	0700	16	7.9	230	297	815	46	26	<0.1	79,000	49,000	9	"
2/2/66	G	1000	18	8.0	23	68	1615	18	11	<0.1	220,000	130,000	5	"
2/2/66	G	1400	19	7.7	28	81	1320	47	22	<0.1	220,000	170,000	2630	"
2/2/66	G	1600	12	7.3	215	1230	1310	11,220	10,000	9.0	4,600,000	1,100,000	30	"
2/2/66	G	1900	18	7.4	15	49	1120	13	13	<0.1	49,000	13,000	7	"
2/2/66	G	2200	17	7.5	9	262	955	6	5	<0.1	79,000	33,000	17	"
2/3/66	G	0100	15	7.8	19	65	1540	17	12	<0.1	110,000	17,000	9	"
2/3/66	G	0400	16	7.9	6	63	1480	9	5	<0.1	49,000	23,000	5	"
2/1/66 to 2/2/66	C	0600 0600	--	7.8	39	146	1260	142	60	0.6	--	--	70	0.04
2/2/66 to 2/3/66	C	0600 0600	--	8.7	145	985	1360	690	520	0.8	--	--	106	0.04

B) Discharge from 8-inch outfall to South Platte River 550 yards north of York Street

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Total Coliform MPN/100ml	Fecal Coliform MPN/100ml	Grease mg/1	Flow MGD
1/27/66	G	1415	27	--	1575	2840	--	--	--	--	2,300,000	790,000	--	<0.01
2/1/66	G	1050	--	7.4	4750	8535	1910	1,550	1,460	2.2	3,300,000	3,300,000	26	"
2/1/66	G	1815	39	7.7	605	1215	1700	399	380	1.0	790,000	490,000	3940	"

MARTIN COMPANY
(DIVISION OF MARTIN-MARIETTA COMPANY)
Highway 75
Littleton, Colorado

Date of Visit: March 27, 1964

Persons Contacted: W. R. Van Nattan, Industrial Hygiene Engineer
R. W. Drake, Manager, Personnel Safety Department
A. M. Chenault, Chief, Industrial Hygiene Department
John McKelvey, Chief, Industrial Waste Department
C. Ames, Supervisor, Waste Treatment Facilities
Jim Holley, Director, Industrial Relations Division

Process and Operation: The Martin Company manufactures and tests intercontinental ballistic missiles and also conducts research for the United States space program and Department of Defense. The establishment is located southwest of Littleton, Colorado in the foothills - mountainous area. Test-firing sites are situated in or near mountainous terrain, and the production and office facilities are located at lower elevations. This manufacturing plant is one of the largest in the State of Colorado. Approximately 12,000 persons were employed in 1964 but this number has decreased to about 6,500 persons as of July 1966. The Company essentially operates on a one-shift basis with starting times between 6:30 and 8:30 AM, and the work week consists of 8 hours per day, 5 days a week. A small part of the personnel are employed on the swing-shifts primarily for maintenance and continuance-operations.

Sources and Uses of Water: The entire plant water supply is received from the Denver Water Board. Domestic needs are served by City water which has been fully-treated. Industrial process and cooling require a lesser quality of water and these needs are fulfilled by receiving water from the municipal system prior to its treatment. Cooling water required on the test-firing sites is obtained from a 1.5 million gallon storage tank located above these sites.

Sources and Characteristics of Wastes: Process wastes originate both from the test and production areas. The missile-testing area produces spent fuel solutions admixed with cooling water. Fuel components are mainly hydrazine and kerosene. Water use during test-firing approximates 20,000 gallons per minute, and the firing period generally is from 2 to 5 minutes.

Production area wastes consist primarily of spent plating solutions. Although plating-room wastes have been reduced to a minimum, occasionally the plating-tank solutions must be discarded. Spent liquors contain hexavalent chromium, hydrogen fluoride, nitric acid, chromic acid, and various cleaners and detergents.

Domestic sewage represents the third major waste source. Domestic sewage is collected in a separate system and total volume amounts to 500,000 gallons per day essentially from the single daytime shift. The strength of raw sewage ranges between 180 and 400 mg/l 5-day BOD.

Treatment and Disposal of Wastes: Liquid wastes originating from the test area are collected into a 500,000 gallon storage and treatment tank. Lime, copper sulfate and hydrogen peroxide are added and the contents of the tank are mixed and aerated which reduces the hydrazine content to 2 mg/l or less. The aerated effluents are transferred to a holding pond and these waters after reaching a proper level of purity may be returned to the 1.5 million gallon water storage tank serving the test area. Treated wastewaters are also released to a second holding pond where the waters after attaining a given quality level, are released into Brush Creek, a tributary of the South Platte River. In the event a slug of toxic wastes were accidentally released through the ponds into Brush Creek, the Company is prepared on short notice to install temporary dams in Brush Creek to withhold and minimize effects of the contaminant body on the South Platte River.

Plating wastes originating from the manufacturing area receive treatment in a series of batch tanks, to which sulfuric acid, lime, sulfur-dioxide, sodium sulfite or other chemicals may be added, depending upon the type and level of waste flow being treated. The chemically-treated wastes are settled, resulting sludges are released into one of two holding lagoons and the liquor body is placed into storage tanks. The sludge from the lagoons is eventually spread on the ground for drying. The liquors in the storage tanks after quality testing are discharged into Brush Creek.

Domestic sewage is handled separately in a conventional-type sewage treatment plant. Treatment consists of primary settling, first-stage trickling filtration, secondary settling, second-stage trickling filtration, and final settling followed by chlorination. Chlorine contact time ranges between 20 and 120 minutes, and the final effluent BOD has a reported range of between 30 and 60 mg/l. Fully-treated sewage is also discharged into Brush Creek.

The Martin Company maintains five test wells for surveillance of the quality of groundwater in the area. These wells range in depth between 30 and 200 feet. Brush Creek is sampled twice daily to check waste treatment operations at the plant and to control waste constituents in the stream below a given level. Lastly, the Martin Company maintains a 24-hour alert with the Denver Water Board, and the Cities of Aurora, Englewood, and Littleton to instantly inform these groups on the occurrence and nature of accidental and toxic waste spills that may occur into Brush Creek and eventually the South Platte River. The waste handling and treatment facilities of the Martin Company provide a relatively high degree of protection for downstream water-using interests.

APPENDIX B - TABLE XXXIII

MARTIN COMPANY
LITTLETON, COLORADO
SAMPLING RESULTS

Combined treated effluents including test-area wastes, plating wastes, and domestic sewage, sampled in Brush Creek, at bridge on gravel road travelling from Martin Company to Waterton, southeast of plant

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	ABS mg/1	Total Cr mg/1	Flow MGD
3/2/65	G	0915	16.0	7.8	7	680	22	22	<0.1	0.9	0.00	1.04
3/2/65	G	1415	8.0	8.2	31	1350	220	44	0.6	0.9	0.04	"
3/3/65	G	0845	6.0	8.3	8	833	44	18	<0.1	0.8	0.15	"
3/3/65	G	1450	8.0	8.1	23	840	72	22	0.1	0.4	--	"
3/4/65	G	0900	5.0	8.0	8	3180	31	13	<0.1	0.5	0.15	"
3/4/65	G	1255	10.0	7.9	16	5620	158	56	0.3	0.2	0.10	"
3/2/65 to 3/3/65	C	1445 1400	5.0	8.0	33	956	31	17	0.2	0.9	0.15	1.04
3/3/65 to 3/4/65	C	1415 1415	5.0	7.5	6	968	32	26	0.1	0.2	0.15	1.04

PACKAGING CORPORATION OF AMERICA
5501 Brighton Boulevard
Denver, Colorado

Date of Visits: March 30, 1964 and subsequent times

Persons Contacted: Ed Boyle, General Manager
Carl Wynstra, Technical Director; Quincy, Illinois

Process and Operation: The Denver plant of the Packaging Corporation of America is classed as a paperboard mill. The establishment manufactures basic categories of plasterboard, box board, and cylinder liner. Average production for the month of February 1964 was 99.0 tons per day. It is interesting that the plant utilizes waste paper grades as raw material rather than pulp. The raw stock for paperboard and boxboard consists of corrugated boxes (60 to 70 percent of total), old newspaper and mixed paper. The top liner stock for white grades is produced from envelope cuttings, magazine shavings and/or "white blank" which is ground wood plus unbleached sulfite. A host of other raw materials include rosin sizing, alum, dyes, chlorine, caustic soda, and starches. Corn starch is used in greatest amounts, together with lesser quantities of wheat and potato starches.

The paperboard mill operates 24 hours a day utilizing 85 persons on a 3-shift basis. The Packaging Corporation of America also maintains other facilities in the Denver area which are dependent upon the mill. Dependent Company operations require another 265 persons.

Sources and Uses of Water: Process water is received from eight 30-feet deep wells, whereas drinking and boiler-makeup supply are obtained from two 600-feet deep wells. Within the process, the majority of water is directed to the cylinder and felt showers, water-cooled bearings at the ends of the paper machines, the water felt conditioner, water seals on the various pumps, and directly in producing top liner product.

Sources and Characteristics of Wastes: Wastewater originates from each of the previously-mentioned water uses to which must be added floor drainage and boiler blowdown. The Denver paperboard mill of the Packaging Corporation of America estimated their daily wastewater volume in February 1964 averaged 590,000 gallons, containing 4000 pounds of 5-day BOD, 6660 pounds of suspended solids, and 201 ml/l of settleable solids. The population equivalents of these reported wastes on the bases of BOD and suspended solids were 24,000 and 33,000 persons, respectively. At that time the plant was manufacturing an average of 99 tons of paper product per day. The liquid wastes from the paperboard mill are high in volume, dissolved organic material and suspended solids with various amounts of paper fines, rosin-size, starch, alum, clays, and coloring.

Treatment and Disposal of Wastes: In 1964, plant treatment of wastewater was extremely minimal. Total wastes were passed through a Bird Save-All utilizing 70-mesh screening and there was some reuse of wastewater in the process. The Company reported an 83 percent reduction and recovery of suspended solids leaving in the effluents. The field survey also noted that the plant was experimenting with a Side-Hill Save-All for recovery of paper fibers. The waste effluents were released into a ditch crossing the plant property, and then entered a pipeline carrying the wastes under the Burlington-O'Brian Canal to the South Platte River at RM 313.3.

The Company in 1964 was considering additional waste treatment and adequate disposal in terms of three alternatives: 1) installation of an activated sludge treatment plant; 2) oxidation lagoons; or 3) disposal of all industrial wastes to the Metropolitan Denver Sewage Disposal District No. 1.

Since 1964, the progress made by the Packaging Corporation of America in coping with its very large industrial waste problems is considered most noteworthy. Waste effluents previously discharged to the South Platte River represented one of the largest and most serious of pollutional loads imposed on that stream. The Company in late 1965 successfully negotiated with MDSDD No. 1 to discharge all its wastes through the new District sewage treatment plant. This contract was the final step in a serious of meetings involving the Company; the Colorado State Department of Public Health; MDSDD No. 1; the TA&I Activities of the FWPCA, Cincinnati, Ohio; and the South Platte River Basin Project, towards convincing the Company of the need for adequate waste treatment. These wastes will be received by the District starting in late - 1966.

APPENDIX B - TABLE XXXIV

PACKAGING CORPORATION OF AMERICA
DENVER, COLORADO
SAMPLING RESULTS

Total waste effluents immediately after screens in concrete ditch on plant property, and before discharge to South Platte River

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	BOD after Settling[a/] mg/1	COD mg/1	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	SO_4 mg/1	Oil mg/1	Flow MGD
9/29/64	G	0800	--	7.5	575	445	764	752	652	40	739	16	0.70
9/29/64	G	1100	--	7.6	340	305	587	444	256	14	629	--	"
9/29/64	G	1510	--	7.2	344	315	568	464	332	48	731	--	"
9/30/64	G	0935	23.5	7.9	675	565	1270	964	764	66	454	27	"
9/30/64	G	1350	37.0	7.8	680	565	1350	840	568	73	470	--	"
9/30/64	G	1545	40.0	7.6	490	580	1250	756	516	67	587	--	"
10/1/64	G	0730	39.0	7.6	760	620	1430	556	404	51	445	15	"
10/1/64	G	1000	43.5	4.6	830	695	--	1810	1490	235	457	--	"
10/1/64	G	1400	38.0	7.4	>585	>540	--	1240	1010	134	405	--	"
9/29/64 to 9/30/64	C	0935 0935	--	6.8	780	610	3960	3180	2820	450	873	--	0.70
9/30/64 to 10/1/64	C	1000 1000	--	7.5	700	515	--	1350	1030	124	477	--	0.70

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a/ Wastes allowed to settle in laboratory for one hour.

PUBLIC SERVICE COMPANY OF COLORADO
Denver, Colorado

Date of Visit: June 16, 1964 and subsequent times

Persons Contacted: W. K. Sutherland, Assistant Chief Betterment Engineer
L. B. Card
Leonard Reichwein
E. M. Callen
Samuel R. Ross

Process and Operation: The Public Service Company of Colorado owns and operates three steam power plants in the Denver Metropolitan area. These three plants all located adjacent to the South Platte River are the Arapahoe unit in southwest Denver directly south of West Evans Avenue on the west side of the River; the Zuni unit at West 13th Avenue on the east side of the River; and the Cherokee unit in north Denver at East 60th Avenue on the west side of the River. The operation of the Public Service Company of Colorado steam electric plants involves the generation of heat from coal or natural gas to produce steam. The steam is used to drive turbines which in turn are coupled to electric generators. After driving the turbine, steam is condensed and reused as boiler-water feed supply. Some steam is lost necessitating makeup water. Fresh water is used to cool and condense the steam but the cooling water gains heat in this process. Consequently cooling waters are discharged to the receiving stream at an elevated temperature.

Sources and Uses of Water: The Arapahoe plant in the year 1963 received 700 MG of water directly from the South Platte River and 41 MG from the City and County of Denver. River water was used as main cooling tower makeup and service water makeup. Municipal water was employed as boiler feed and for domestic needs. Main cooling tower makeup needs were 693 MG and service water makeup was 7 MG. In boiler water treatment, 17 MG of water was passed through the zeolite softeners for use in the boilers. Backwash requirements on the softeners amounted to 22 MG, and the remainder of municipal water supply or 2 MG was directed to sanitary services.

The Zuni plant in the year 1963 received 228 MG of water directly from the South Platte River and 188 MG from the City and County of Denver facilities. As in the case of the Arapahoe plant, River water was employed as main cooling tower makeup and for service water makeup, whereas municipal water was used as boiler feed input and for domestic needs. Makeup for the main cooling towers required 226 MG and service water makeup required 2 MG. Approximately 132 MG of water were treated by lime soda and zeolite softeners for boiler feed, and in this process another 55 MG of water was necessary for the washing and regeneration of the softening units. Domestic in-plant uses utilized 1.0 MG of water.

The Cherokee plant in 1963 obtained 46 MG from four deep wells, 1667 MG from the South Platte River, and 9 MG from the City and County of Denver. River water is used exclusively for main cooling tower makeup. The deep wells and City water are utilized jointly for boiler feed, service water makeup and domestic services. Approximately 19.5 MG of water were treated by zeolite softeners for boiler feed input and another 16.7 MG of water was necessary for the washing and regeneration of softening units. Service water makeup amounted to 17.3 MG, and domestic services required 1.3 MG of water.

Sources and Characteristics of Wastes: Discarded cooling waters primarily from the cooling towers represent the large majority of wastewater volume from a steam power station. Reuse of cooling waters and consequently evaporation rates were relatively high at the three Public Service Company of Colorado steam plants. Cooling water volumes (including both main cooling tower and service water needs) from the point of intake to the point of discharge back to the River were reduced 70 to 71 percent by evaporation within the three plants. The spent cooling water returns amounting to 29 to 30 percent of the original draft, carry approximately the same amount of total solids present in the water intake. Therefore, these returns although creating no increase in total solids loads in the River are in themselves more highly concentrated in solids level as compared to the River. Additionally, it must be noted for the three plants that City water used for treatment of boiler feed supply in major part is converted into wastewater and also enters the South Platte River.

An overall water balance supplied by the Company for each of the three plants representing total operation throughout 1963 indicated that the Arapahoe unit discharged 159 MG of spent cooling water and 22 MG of backwash wastes from boiler feed treatment to the South Platte River during the year. Respective values for the Zuni unit were 52 MG and 55 MG, and similar values for the Cherokee unit were 378 MG and 17 MG.

Information compiled at the three Public Service Company of Colorado plants on the characteristics of various waste flows other than the spent cooling waters was not complete. Nevertheless, Nemerow[a/] lists eleven additional wastes which are worthy of consideration. These are:

"1) Hot, concentrated water salines from boiler and evaporator blowdown

2) Acid and alkaline chemical solutions used in cleaning power-plant equipment

3) Water from blowdown of cooling towers, containing minerals in high concentrations

4) Waste water from washing stack gases

[a/] Nemerow, N.L., "Theories and Practices of Industrial Waste Treatment," 1963, Addison-Wesley Publishing Co., Inc., Reading, Massachusetts

5) Acid and caustic solutions resulting from the regeneration of ion-exchange softeners and demineralization water treatment plants which are used for conditioning feed water for boilers and evaporators

6) Hot alkaline water from blowing down chemical softening plants

7) Acid water drainage from coal storage

8) Drainage from cinder and ash dumps

9) Sanitary sewage

10) Oil, greases, and miscellaneous solid and liquid wastes ...." and

"11) Fly ash, a solid waste resulting from the use of pulverized coal. These wastes too often are allowed to find their way into the receiving stream body."

In the case of the three Denver steam power plants, sanitary sewage was reported as discharged completely to the City and County of Denver municipal sewers.

Treatment and Disposal of Wastes: Adequate data on waste handling and treatment facilities employed by the three steam power plants of the Public Service Company of Colorado in the Denver area was not requested of the Company at the time of plant visits. A partial picture was developed for the Zuni plant where fly ash lagoon overflow and periodic release of backwash from the water softeners in boiler feed treatment were observed to be entering the South Platte River. Furthermore, these effluents were sampled during the Industrial Waste Survey and the data show that excess amounts of pollutant materials were definitely being released to the River. Sampling was conducted on five outfalls of the many entering the River from the three power plants. Further study appears warranted for the three Public Service Company of Colorado power plants regarding industrial waste handling and treatment practices, together with additional sampling in the future.

APPENDIX B - TABLE XXXV

PUBLIC SERVICE COMPANY
OF COLORADO
ARAPAHOE PLANT - DENVER, COLORADO
SAMPLING RESULTS

18-inch outfall to South Platte River upstream of West Evans Avenue

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	ABS mg/1	Flow MGD
1/28/66	G	1310	7.0	8.8	<5	27	905	43	13	<0.1	0.2	1.01

APPENDIX B - TABLE XXXVI

PUBLIC SERVICE COMPANY
OF COLORADO
ZUNI PLANT - DENVER, COLORADO
SAMPLING RESULTS

A) 24-inch outfall from fly ash lagoon to the South Platte River, 100 feet south of 13th Avenue

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/l	COD mg/l	Cond. umhos	TSS mg/l	VSS mg/l	Settl. Sol. ml/l	ABS mg/l	Flow MGD
1/28/66	G	1420	11.0	7.4	10	65	860	267	22	0.5	0.5	1.15

B) 2x4-foot outfall to the South Platte River, 130 feet north of 13th Avenue, sampled at end of concrete sluice box

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/l	COD mg/l	Cond. umhos	TSS mg/l	VSS mg/l	Settl. Sol. ml/l	ABS mg/l	Flow MGD
1/28/66	G	1420	10.5	7.4	9	43	785	44	16	<0.1	0.8	1.44

C) 16-inch outfall to the South Platte River, 130 feet north of 13th Avenue

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/l	COD mg/l	Cond. umhos	TSS mg/l	VSS mg/l	Settl. Sol. ml/l	ABS mg/l	Flow MGD
1/28/66	G	1415	11.0	8.1	9	51	825	98	37	0.1	0.9	0.03
1/31/66	G	1000	--	9.4	--	5,200	--	406,600	28,400	1,000	--	"

APPENDIX B - TABLE XXXVII

PUBLIC SERVICE COMPANY
OF COLORADO
CHEROKEE PLANT - DENVER, COLORADO
SAMPLING RESULTS

A) 42-inch outfall to the South Platte River, 730 yards south of Sand Creek confluence

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	ABS mg/1	Flow MGD
1/28/66	G	1000	10.0	7.5	7	55	1210	60	20	0.1	1.1	2.16

B) 24-inch outfall to the South Platte River, 700 yards south of Sand Creek confluence

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	ABS mg/1	Flow MGD
2/7/66	G	1050	12.0	7.6	13	78	1180	142	20	0.3	0.6	0.08

SHWAYDER BROTHERS, INC.
(SAMSONITE CORPORATION)

1050 South Broadway
Denver, Colorado

Dates of Visits: March 31, 1964; October 9, 1964; and January 12, 1965

Persons Contacted: Mort Rechnitz, Chief Engineer
Charles Bell, Manager, Design Engineer
James Jenkin, Product Engineer
Signe Schjelderup, Chief Chemist
Donald Eicher, Draftsman

Process and Operation: Shwayder Brothers, Inc. manufactures principal lines in luggage, toys, and furniture. The Company on April 6, 1965 revised its corporate structure under the name of the Samsonite Corporation with headquarters in Denver, Colorado. Associated operations and holdings are also maintained in Murfreesboro, Tennessee (furniture manufacturing), Loveland, Colorado (Lego toy division), together with subsidiary operations in Europe, Japan, Mexico, and Canada.

The Denver factory of Shwayder Brothers, Inc. principally engaged in the manufacture of luggage, employs about 1,800 persons most of which work 8 hours daily, 5 days each week. Maintenance crews are necessary on the swing shifts. The plant normally operates 11 months during each year.

Sources and Uses of Water: Plant water supply averaging 1.1 MGD is received from the City and County of Denver and from two Company wells. The City supply approximates 0.5 MGD and the remainder originates from the wells. Factory water uses include boiler makeup, cooling, makeup in the plating room, water for paint-stripping, and for culinary and domestic needs.

Sources and Characteristics of Wastes: Plant wastes may be classed into three types: 1) sanitary and culinary; 2) spent cooling waters and; 3) wastes from the metal finishing operations.

Culinary wastes represent an important part of the total picture. Company personnel estimated that 750 full meals are prepared and distributed daily. In addition, about 1350 persons partake in small lunches or snacks during the day.

Spent cooling waters originate from air compressors, plastic extruders and other plant equipment. Blowdown from the boilers also occurs.

Metal finishing wastes originate from paint stripping and metal plating operations. Paint stripping utilizes a strong caustic solution which is neutralized in mixing with other plant wastes. The spent caustic carries large amounts of waste organic material and solids. Rinsing and dump wastewaters from the plating areas contain significant levels of chromium, cyanide, and metallics such as cadmium, zinc, copper, and nickel. Cyanide and chrome plating operations are maintained separate within the plant.

Treatment and Disposal of Wastes: The Company provides no in-plant treatment of wastes. Domestic and sanitary wastes amounting to 0.40 MGD are discharged entirely to the City and County of Denver municipal sewers. The process wastewater including all metal finishing liquors and residues together with cooling waters enter the Mississippi Avenue storm sewer and are fully disposed of into the South Platte River. The respective flow rates of metal finishing wastewaters and spent cooling waters were estimated as 0.42 MGD and 0.30 MGD.

Existing waste handling and treatment facilities employed by Shwayder Brothers, Inc. were found to be grossly inadequate and the procedure in disposing of untreated process wastes to the River should be ceased as soon as practicable. The logical solution would consist of adequate pre-treatment of process wastes at the plant site with subsequent discharge of total plant wastes to the Metropolitan Denver Sewage Disposal District No. 1. Careful monitoring of in-plant treatment with a slow, continuous release of plating liquors into the sanitary system would be required. In view of the seriousness of the overall stream pollution picture in the South Platte River Basin, the Company should reappraise its position on waste abatement and treatment. This philosophy should apply both to its southwest Denver factory and new operations envisioned for northeast Denver.

APPENDIX B - TABLE XXXVIII

SHWAYDER BROTHERS, INC.
DENVER, COLORADO
SAMPLING RESULTS

Cyanide plating wastes sampled inside factory cyanide plating room, before discharge to plant sewer leading to storm sewer and the South Platte River

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/l	COD mg/l	Cond. umhos	TSS mg/l	VSS mg/l	Settl. Sol. ml/l	CN mg/l	Total Cr mg/l	Flow MGD
2/16/65	G	0930	15	8.0	16	40	1410	11	9	<0.1	16.0	0.01	0.109
2/16/65	G	1430	--	8.4	8	32	1230	48	--	<0.1	15.0	0.03	"
2/17/65	G	0935	16	10.5	--	1710	8470	911	677	0.1	44.0	0.06	"
2/17/65	G	1430	--	8.0	6	40	1450	12	9	<0.1	12.0	0.01	"
2/18/65	G	0855	16	7.6	--	18	1170	5	5	<0.1	1.1	0.02	"
2/18/65	G	1400	15	7.9	4	18	1060	3	3	<0.1	4.8	0.60	"
2/15/65 to 2/16/65	C	1130 1120	--	6.6	27	121	3200	39	23	<0.1	66.0	0.08	0.109
2/16/65 to 2/17/65	C	1120 1120	--	9.1	--	99	1540	36	36	0.1	42.0	0.21	0.109
2/18/65 to 2/19/65	C	0930 0930	--	9.2	--	15	1740	119	60	0.9	46.0	0.39	0.109

APPENDIX B - TABLE XXXIX

SHWAYDER BROTHERS, INC.
DENVER, COLORADO
SAMPLING RESULTS

Spent cooling waters sampled inside factory, before discharge to plant sewer leading to storm sewer and the South Platte River

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Flow MGD
2/16/65	G	0920	9	8.0	--	14	412	4	4	< 0.1	0.30
2/16/65	G	0940	17	7.6	--	--	1280	5	5	< 0.1	"
2/16/65	G	1420	--	7.6	--	--	1260	2	--	< 0.1	"
2/16/65	G	1445	15	7.9	29	--	1970	343	--	0.5	"
2/17/65	G	0920	--	7.7	--	--	1340	2	2	< 0.1	"
2/17/65	G	1425	--	7.9	--	--	1290	3	2	< 0.1	"
2/18/65	G	0850	--	7.6	--	--	1220	3	3	< 0.1	"
2/18/65	G	1355	16	7.6	--	--	1200	4	4	0.2	"
2/18/65	G	1400	--	7.5	--	--	1210	7	2	< 0.1	"
2/15/65 to 2/16/65	C	1050 1050	--	7.6	4	--	1260	5	--	< 0.1	0.30
2/16/65 to 2/17/65	C	1410 1100	--	7.8	4	--	1280	4	4	< 0.1	0.30
2/17/65 to 2/18/65	C	1115 0900	--	7.6	--	--	1150	5	4	< 0.1	0.30
2/18/65 to 2/19/65	C	0925 0925	--	8.0	4	--	1240	8	8	< 0.1	0.30

APPENDIX B - TABLE XL

SHWAYDER BROTHERS, INC.
DENVER, COLORADO
SAMPLING RESULTS

Paint-stripping wastes sampled from sump inside factory paint-stripping room before discharge to plant sewer leading to storm sewer and the South Platte River

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Phenols mg/1	Flow MGD
2/16/65	G	1410	--	7.9	--	10	426	17	--	<0.1	--	0.048
2/17/65	G	0925	8	9.8	--	85	688	21	5	<0.1	--	"
2/17/65	G	1400	--	8.8	--	1310	499	1860	1710	0.5	0.2	"
2/18/65	G	0855	6	7.9	--	13	3400	4	4	<0.1	0.1	"
2/18/65	G	1300	10	3.6	--	16	1370	17	17	<0.1	0.3	"
2/15/65 to 2/16/65	C	1140 1115	--	9.9	263	310	865	273	158	11.0	16.0	0.046
2/16/65 to 2/17/65	C	1115 1110	--	9.9	--	--	1450	194	32	0.3	5.7	0.048
2/17/65 to 2/18/65	C	1110 0930	--	9.6	--	14	813	146	66	2.0	--	0.048
2/18/65 to 2/19/65	C	0950 0950	--	10.2	--	--	1150	169	71	5.5	12.0	0.048

APPENDIX B - TABLE XLI

SHWAYDER BROTHERS, INC.
DENVER, COLORADO
SAMPLING RESULTS

Chrome plating wastes sampled from sump inside factory chrome plating room before discharge to plant sewer leading to storm sewer and the South Platte River

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	CN mg/1	Total Cr mg/1	Flow MGD
2/16/65	G	1000	14	7.5	--	12	1190	8	8	<0.1	2.2	0.71	0.311
2/16/65	G	1415	--	7.5	--	--	1100	4	--	<0.1	0.4	0.89	"
2/17/65	G	0930	14	7.6	--	6	1170	9	4	0.1	0.2	0.78	"
2/17/65	G	1440	15	8.0	10	21	1190	7	6	<0.1	0.2	0.02	"
2/18/65	G	0855	17	7.6	--	7	1080	8	4	<0.1	0.1	0.76	"
2/18/65	G	1345	--	7.3	--	2	1150	6	5	<0.1	0.1	0.28	"
2/16/65 to 2/17/65	C	1120 1100	--	8.2	7	23	1200	10	5	<0.1	1.0	0.76	0.311
2/17/65 to 2/18/65	C	1100 0930	--	7.6	8	3	1060	12	6	<0.1	0.3	0.49	0.311
2/18/65 to 2/19/65	C	0940 0940	--	8.0	--	--	1160	8	6	<0.1	1.9	0.30	0.311

STAPLETON INTERNATIONAL AIRPORT
Denver, Colorado

Dates of Visits: August 6, 10, 11, 12 and 17, 1964

Persons Contacted: Herman Gassert, Airport Maintenance Superintendent
George Hammer, Foreman in Charge of Buildings
Charles W. Baston, Director of Maintenance, Continental Airlines
Albert L. Schroth, Engineer, Continental Airlines
Dale Norton, Vice-President in Charge of Maintenance, Combs Aircraft
Bart Johnson, Assistant Shop Foreman, Clinton Aviation
Richard Dreyer, Maintenance Supervisor, Western Airlines
Walt Livermore, Assistant to the Lines Maintenance Manager, United Airlines
Brice Garner, Superintendent of Fleet Service, Frontier Airlines
Walter Scott, Foreman of Engine Shop, Frontier Airlines

Process and Operation: Stapleton International Airport is owned and maintained by the City and County of Denver. Maintenance functions are the responsibility of the Public Works Department of the City. Individual companies located at the Airport rent their necessary building and hangar space from the City government. Location of the various lessees is shown in the accompanying figure. The major water-using and waste-producing units at the Airport include the following:

1. Clinton Aviation Company
2. Combs Aircraft, Inc.
3. Continental Airlines
4. Frontier Airlines
5. Skychef Crossroads West
6. Stapleton International Airport (overall maintenance and passenger service functions)
7. United Airlines
8. Western Airlines

Minor water-using and waste-producing units include Trans-World Airlines, Inc., the United States Post Office, and the United States Weather Bureau.

Clinton Aviation provides for washing, paint-stripping, overhaul, and general maintenance of small-type aircraft. Combs Aircraft provides more or less the same services for small-type aircraft as Clinton Aviation but its activities appear to be directed more towards washing rather than repairing aircraft. Continental Airlines operations include passenger services, the washing of airplanes, washing and cleaning in engine-overhaul, plating of metal parts, maintenance of the flight kitchen and miscellaneous activities. Frontier Airlines provides passenger services, the washing of airplanes, and minor maintenance functions. Skychef Crossroads West prepares food and operates a restaurant within the Airport. United Airlines operates passenger services, the washing of airplanes and ground equipment, and also maintains a flight kitchen. United Airlines does not perform engine overhaul at the Denver location. Western Airlines maintains passenger services and very limited maintenance for their airplanes in Denver.

Sources and Uses of Water: All the water supply for the Airport area is received from the City and County of Denver municipal system. Specific water uses are associated with the individual company operations given previously. Water usage is directed to general categories as follows: the washing and cleaning of aircraft, various activities in the aircraft maintenance shops, cleaning and maintenance of buildings, the flight kitchens, air conditioning, and domestic sanitary needs.

Approximate water use by the Airport in the year 1963 is shown below:

Unit	Water Use - Gallons per Year
Clinton Aviation	504,000
Combs Aircraft	537,000
Continental Airlines	13,187,000
Frontier Airlines	3,671,000
Skychef Crossroads West	17,155,000
Stapleton International Airport	35,094,000
Trans-World Airlines	36,000
United Airlines	26,362,000
U. S. Post Office and Weather Bureau	414,000
Western Airlines	109,000
Total	97,069,000

Sources and Characteristics of Wastes: Industrial wastes originate from the washing of airplanes, overhaul and cleaning of engines, plating and stripping of metal parts, spent cooling waters, boiler-blowdown, and general aircraft maintenance. These wastes may be essentially classed as soapy and oily with various amounts of chemicals including metallics. Practically all industrial wastes are reported to be discharged to the storm sewers serving the Airport property and are finally disposed of into Sand Creek.

Clinton Aviation experiences wastes containing cleaning solutions, oils and solvents from washing of airplanes and from engine cleaning and overhaul. Paint-stripping also contributes wastewater with solvent, metals, and paint particles.

Combs Aircraft receives the majority of its wastewater from the washing of aircraft. The Company strips and repaints an airplane on the average of once every three weeks and discharges stripping solution and old paint to the storm sewer.

Continental Airlines produces wastes from airplane washing, rinsing of parts in their plating and anodizing operations, and from overhaul and cleaning of engines and engine parts. Spent batches of concentrated plating solution are collected into drums and taken to a dump area.

Frontier Airlines accumulates liquid wastes from airplane washing and floor cleaning. Approximately once every three months, painting solution, metals and other materials are discharged to the storm sewer from the stripping and repainting of aircraft parts.

United Airlines has wastewater containing cleaning and washing solutions but very little oil.

Western Airlines produces relatively limited wastewater originating entirely from the hangar floor drains and apparently containing only small quantities of oil.

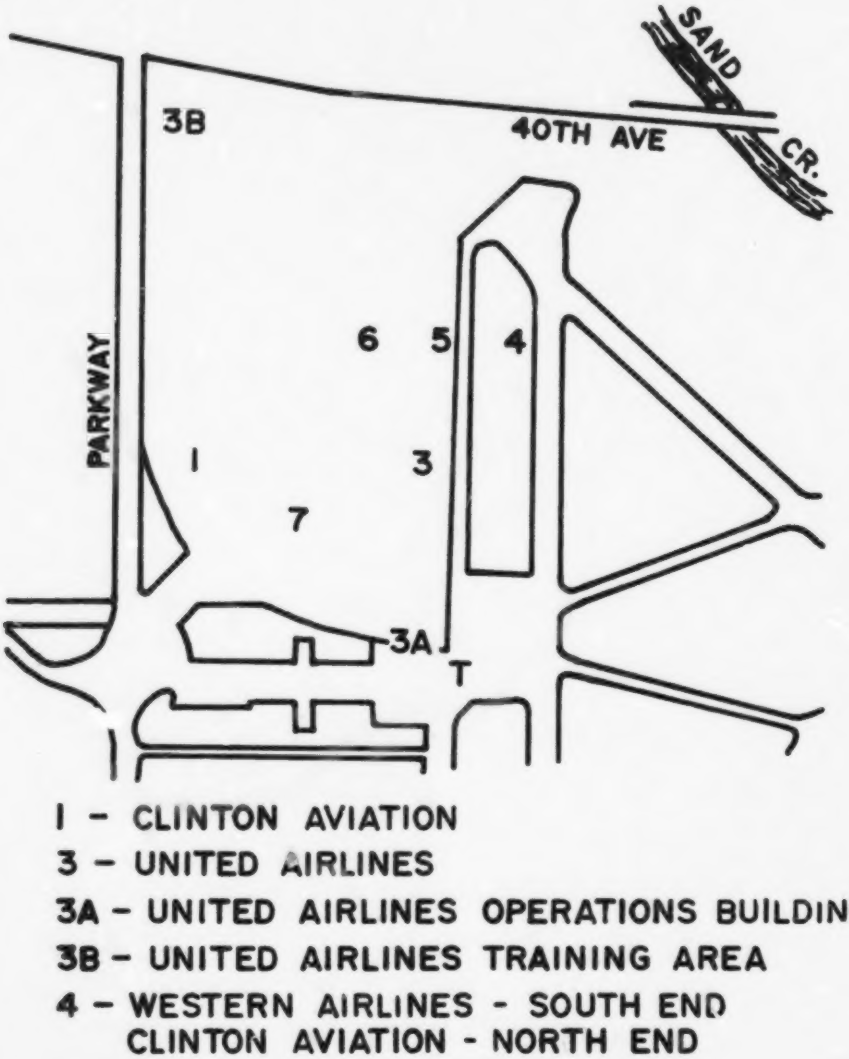
Domestic, culinary and commercial wastes originate from the terminal concessions, the flight kitchens, remaining sanitary services spread throughout the hangars and Airport buildings, and as domestic sewage removed from incoming airplanes. These wastes totally enter the sanitary sewers of the City and County of Denver.

Collection, Treatment and Disposal of Wastes: There are at least four main sewers conveying industrial wastes from the Airport to Sand Creek. Two storm sewers intercept Sand Creek below the north-south runway, a third sewer enters the stream some distance upstream of the runway, and a fourth line reaches Sand Creek via a twin 24-inch outfall immediately below the runway. Field observations indicated that the large majority of waste flow from the Airport was entering Sand Creek by means of the twin outfall. Of the various outfalls, only the twin outfall was sampled during the study.

The survey of the hangar and building locations indicated that hangars 4, 5, 6 and 7 which includes most of the Aircraft and Airlines Companies, are served by wastewater sumps with facilities for oil and sand removal. Clinton Aviation provides no apparent on-site waste recovery; the wastes from Combs Aircraft pass through a small sump prior to the storm sewer; Continental Airlines route their wastes through a series of sumps or pits prior to the sewer, and also recover the oils drained from the engines; Frontier Airlines recovers oils drained from the engines and also diverts part of their industrial wastes to the Denver sanitary sewer between the hours of 12 Midnight and 6 AM; only part of the United Airlines operations is served by a sump located in Hangar 5; and lastly the wastes from Western Airlines enter a sump before reaching the storm sewer.

The wastewaters via the storm sewers to Sand Creek contain cleaning solutions, oils and greases, solvents, paint particles, spent plating solutions with various amounts of heavy metals, and miscellaneous chemical materials. Treatment appurtenances are greatly lacking to cope with this complex mixture of wastes which would seem to be a responsibility of the City and County of Denver. Also, the existing treatment devices receive little or practically no attention adding to the serious nature of pollution in Sand Creek. The industrial waste survey included sampling of Sand Creek waters both above and below the Airport. These results verified existing gross pollution in the stream.

STAPLETON AIRFIELD
DENVER, COLORADO
HANGAR LOCATIONS



1 - CLINTON AVIATION
3 - UNITED AIRLINES
3A - UNITED AIRLINES OPERATIONS BUILDING
3B - UNITED AIRLINES TRAINING AREA
4 - WESTERN AIRLINES - SOUTH END
CLINTON AVIATION - NORTH END
5 - UNITED AIRLINES - SOUTH END
FRONTIER AIRLINES - NORTH END
6 - CONTINENTAL AIRLINES
7 - COMBS AIRCRAFT
T - TERMINAL

APPENDIX B
FIGURE 7

APPENDIX B - TABLE XLII

STAPLETON INTERNATIONAL AIRPORT
DENVER, COLORADO
SAMPLING RESULTS

Sand Creek sampled above Airport at Havana Street

Dates of Sampling	Type of Sample	Time	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Phenols mg/1	Flow MGD
9/1/64	G	0915	7.8	--	154	1400	236	183	(.091)a/	2.0
9/1/64	G	1420	7.9	--	58	1230	47	34	( )	"
9/2/64	G	0925	7.6	73	395	1620	168	137	(.068)a/	"
9/2/64	G	1330	7.8	34	85	1380	43	27	( )	"
9/3/64	G	0800	8.0	48	43	2460	126	54	--	"

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a/ The numerical value represents a composite of the two grab samples.

APPENDIX B - TABLE XLIII

STAPLETON INTERNATIONAL AIRPORT
DENVER, COLORADO
SAMPLING RESULTS

Effluent from Aurora Westerly sewage treatment plant into Westerly Creek

Dates of Sampling	Type of Sample	Time	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Phenols mg/1	Flow MGD
9/1/64	G	0940	7.4	--	70	1390	103	59	( )a/	3.5
9/1/64	G	1140	7.5	--	76	1760	46	45	(.091)	"
9/1/64	G	1435	7.6	--	80	1580	36	36	( )	"
9/1/64	G	1555	7.5	--	88	1620	38	34	( )	"
9/2/64	G	0805	7.3	45	122	1570	41	25	( )a/	"
9/2/64	G	0940	7.4	44	116	1750	40	31	(.034)	"
9/2/64	G	1230	7.5	22	84	1860	43	38	( )	"
9/2/64	G	1410	7.5	30	110	1840	45	37	( )	"
9/3/64	G	0750	7.5	39	124	1830	35	30	--	"
9/3/64	G	1045	7.4	32	103	1540	42	29	--	"

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a/ The numerical value represents a composite of the four grab samples.

APPENDIX B - TABLE XLIV

STAPLETON INTERNATIONAL AIRPORT
DENVER, COLORADO
SAMPLING RESULTS

Sand Creek sampled under north-south runway

Dates of Sampling	Type of Sample	Time	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Phenols mg/1	Flow MGD
9/1/64	G	0900	--	52	--	--	--	--	.046 a/	7.0
9/1/64	G	1145	--	42	--	--	--	--		"
9/1/64	G	1400	--	50	--	--	--	--		"
9/1/64	G	1535	--	48	--	--	--	--		"
9/2/64	G	0905	--	56	--	--	--	--	.016 a/	"
9/2/64	G	1025	--	42	--	--	--	--		"
9/2/64	G	1310	--	41	--	--	--	--		"
9/2/64	G	1515	--	47	--	--	--	--		"
9/3/64	G	0820	7.5	44	128	1470	77	55	--	"
9/3/64	G	1025	7.6	42	150	1570	74	47	--	"
9/1/64 to 9/2/64	C	1045 1045	7.4	46	131	1720	109	68	--	7.0
9/3/64 to 9/4/64	C	1045 0920	7.6	43	126	1630	49	32	--	7.0

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a/ The numerical value represents a composite of the four grab samples.

APPENDIX B - TABLE XLV

STAPLETON INTERNATIONAL AIRPORT
DENVER, COLORADO
SAMPLING RESULTS

Sand Creek sampled below Airport at railroad bridge located at extension of Smith Road and adjacent to Yosemite Street

Dates of Sampling	Type of Sample	Time	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Phenols mg/1	Flow MGD
9/1/64	G	0830	--	52	--	--	--	--	.077 [a]	7.6
9/1/64	G	1115	--	70	--	--	--	--		"
9/1/64	G	1500	--	44	--	--	--	--		"
9/1/64	G	1520	--	52	--	--	--	--		"
9/2/64	G	0830	--	64	--	--	--	--	.080 [a]	"
9/2/64	G	1000	--	59	--	--	--	--		"
9/2/64	G	1250	--	54	--	--	--	--		"
9/2/64	G	1440	--	39	--	--	--	--		"
9/3/64	G	0900	7.6	49	138	1470	66	46	--	"
9/3/64	G	1000	7.8	176	194	1550	234	150	--	"
9/1/64 to 9/2/64	C	0830 0830	7.7	66	149	1710	111	75	--	7.6
9/3/64 to 9/4/64	C	0900 0900	6.8	48	144	1790	102	72	--	7.6

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[a] The numerical value represents a composite of the four grab samples.

APPENDIX B - TABLE XLVI

STAPLETON INTERNATIONAL AIRPORT
DENVER, COLORADO
SAMPLING RESULTS

Twin 24-inch outfalls to Sand Creek adjacent to north-south runway

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Oil mg/1	ABS mg/1	Phenols mg/1	Flow MGD
9/29/64	G	0840	--	7.6	80	75	20	20	<0.1	14	( )[a]	( )[a]	0.1
9/29/64	G	1045	--	7.7	>438	545	42	32	<0.1	48	(22)	(0.75)	"
9/29/64	G	1450	--	7.9	>352	1700	71	58	<0.1	34	( )	( )	"
9/30/64	G	0900	20	7.4	390	353	42	42	<0.1	41	( )[a]	( )[a]	"
9/30/64	G	1340	26	7.6	>438	984	24	20	<0.1	20	(32)	(0.65)	"
9/30/64	G	1510	20	7.6	>335	1030	195	166	<0.1	87	( )	( )	"
10/1/64	G	0750	15	8.7	>445	2250	120	100	<0.1	118	( )[a]	( )[a]	"
10/1/64	G	1030	17	9.6	>460	--	184	118	<0.1	87	(173)	(7.8)	"
10/1/64	G	1325	20	7.8	155	--	59	46	<0.1	87	( )	( )	"
9/29/64 to 9/30/64	C	0900 0900	--	7.4	335	375	41	38	<0.1	15	24	--	0.1
9/31/64 to 10/1/64	C	0900 0900	--	8.8	>455	784	104	75	<0.1	--	64	--	0.1

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[a] The numerical value represents a composite of the three grab samples.

APPENDIX B - TABLE XLVII

INDUSTRY WASTE SURVEY
STAPLETON INTERNATIONAL AIRPORT

Summary of waste sampling data on Sand Creek, the twin Airport outfall, and the Aurora Westerly sewage treatment plant

Station Description	River Mile	Dates	Type of Sample	Flow MGD	BOD mg/1	TSS mg/1	Phenols mg/1	BOD Lbs/Day	TSS Lbs/Day	Phenols Lbs/Day
Sand Creek at Havana Street	312.1/6.2	9/1-3/64	G	2.0	51	125	0.080	805	2,090	1.30
Effluent from Aurora sewage treatment plant to Westerly Creek	312.1/5.4/1.1	9/1-3/64	G	3.5	35	45	0.063	1,020	1,310	1.84
Sand Creek under north-south runway	312.1/5.3	9/1-3/64	G	7.0	44	76	0.031	2,570	4,430	1.81
Twin 24-inch outfalls entering Sand Creek	312.1/5.3	9/29/64 to 10/1/64	G	0.1	>344	84	3.10	>290	70	2.60
Sand Creek at railroad bridge below Airport	312.1/4.9	9/1-3/64	G	7.6	104	150	0.079	6,600	9,500	5.00

SWIFT AND COMPANY
Adjacent to Denver Union Stockyard Company
Denver, Colorado

Date of Visit: Fall and Winter 1964 - 1965

Discussion: Limited data was obtained from Swift and Company regarding process operations and sources and magnitude of wastes from industrial activities. Swift and Company conducts packinghouse operations which includes the slaughtering and processing of beef cattle and the rendering of blood, meat scraps and bone on the plant premises. The Company maintains about one-half acre of cattle holding pens.

Swift and Company employs rotary screens for the removal of paunch manure solids. The solids are disposed of to the Ruedy Fertilizer Company and the screened drainage is discharged to the Denver sanitary sewers. Pen manure is disposed to the Ruedy Fertilizer Company and excess livestock drinking water from the pen area is reportedly released to the Denver sewers. Liquid wastes from the establishment not reaching the sanitary sewers are placed in a plant sewer which intercepts a second discharge line leading from the south cattle pens of the Denver Union Stockyard Company into the South Platte River at RM 314.9. The point of discharge to the River is located 100 yards south of the cattle overpass. Sampling of the plant sewer leading to the River showed the presence of important waste loads.

Recent information indicates that the Swift and Company packinghouse ceased operations in August 1966 due to economic and other factors.

APPENDIX B - TABLE XLVIII

SWIFT AND COMPANY
DENVER, COLORADO
SAMPLING RESULTS

Company wastes sampled on plant sewer at manhole inside plant property line

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Flow MGD
1/26/65	G	0830	10.0	7.6	4	1340	15	9	<0.1	0.09
1/26/65	G	1205	9.0	7.6	174	1300	241	178	3.5	"
1/27/65	G	0850	11.0	7.8	4	1450	13	10	<0.1	"
1/27/65	G	1420	11.0	7.8	6	1370	15	6	<0.1	"
1/28/65	G	0810	11.0	7.8	6	1340	28	20	0.2	"
1/28/65	G	1450	11.5	7.8	70	1870	48	35	<0.1	"
1/25/65 to 1/26/65	C	1000 1000	--	7.8	76	1450	122	92	0.7	0.09
1/26/65 to 1/27/65	C	1000 1000	--	7.7	48	1480	101	79	0.9	0.09

TENNECO OIL COMPANY

5800 Brighton Boulevard
Commerce City, Colorado

Date of Visit: April 14, 1964

Persons Contacted: R. R. Rankin, Superintendent
Walt Lackemann, Chief Chemist

Process and Operation: The Tenneco Oil Company owns and operates a petroleum refinery located in Commerce City. Operations comprise desalting of crude oil, crude topping, catalytic reforming, fluid catalytic cracking, and catalytic polymerization. Plant input of crude oil, the majority of which originates in the Wyoming oil fields, approximates 11,000 barrels per day. The crude averages 0.2 percent sulfur content with a maximum of 0.5 percent. Other raw materials include about 600 pounds of chromates and 3,000 gallons of sulfuric acid received on a per month basis. Refinery products are gasoline, kerosene, burner oil-diesel, furnace, or heating oil, and residual fuel oil for industry.

The plant operates 24 hours per day, 7 days a week. Shutdown normally accounts for 4 weeks during each year occurring at various times. The Company employs 42 people in the refinery and 14 in the office. The swing shifts require a total of 11 persons.

Sources and Uses of Water: Plant water supply is received from 6 wells, of which two are shallow wells, 40 and 46 feet in depth, and the other four vary in depth from 700 to 1600 feet. The capacity of individual wells varies from 29,000 to 121,000 gallons per day. The 700-foot well, termed Well No. 1, supplies drinking water, sanitary needs and boiler supply. The remaining 5 sources supply water for cooling purposes and boiler feed. Cooling represents the largest single in-plant use of water. Total water utilization by the plant approximates 410,000 gallons per day. Of this amount, an average of 210,000 gallons per day are consumed or lost through steam escape, cooling water evaporation and other, leaving a residual wastewater of 190,000 to 200,000 gallons per day.

Sources and Characteristics of Wastes: Major sources of process wastes are spent cooling waters, condensates from receivers in the crude unit and the catalytic cracking unit, and residuals from the catalytic reforming process. The various waste streams contain high values of hydrogen sulfide, mercaptans, phenols, and oil emulsions. Cyanide levels may also be significant. The alkaline solution resulting from the caustic wash is recovered and sold to a commercial outlet.

Treatment and Disposal of Wastes: Sour water condensates from the cracking operations amounting to about 40 gpm together with waste streams from the catalytic receivers and stripper units, are admixed in a holding tank. The contents of the holding tank are then conveyed to a flue-gas stripper where phenols are driven-off and burned. The liquid wastes next receive partial treatment in a desalting chamber. At this point the sour water condensates are combined with various oily wastes originating from the plant and the mixture passes through an oil separator. The separator, 25 by 25 feet by 8 feet in depth, provides approximately 21 hours of waste detention and this unit recovers between 10 to 15 barrels of slop oil per day. The waste flow entering the oil separator is in the order of 43,000 gallons per day. The underflow from the separation tank is combined with untreated spent cooling water and small amounts of boiler blowdown wastes in a small ditch which in turn discharges to Sand Creek. Field observations noted that small amounts of catalyst in the final effluent imparted a grayish-black appearance to the wastewater entering Sand Creek.

The Tenneco Oil Company has improved the degree of waste recovery and treatment in their plant over the past 2 to 3 years but some problems remain. Company officials appear to be cognizant of the need for strict monitoring and additional in-plant changes to further improve the quality of waste effluents. The flue-gas stripper is thought to be somewhat overloaded and corrections are envisioned. The Company is also considering the addition of biological waste treatment and/or connection to the Metropolitan Denver Sewage Disposal District No. 1.

APPENDIX B - TABLE XLIX

TENNECO OIL COMPANY
COMMERCE CITY, COLORADO
SAMPLING RESULTS

Total waste discharge from plant to Sand Creek sampled in ditch approximately 30 yards from stream

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/l	COD mg/l	TSS mg/l	VSS mg/l	Settl. Sol. ml/l	Oil mg/l	Phenols mg/l	Flow MGD
10/6/64	G	1000	34	9.0	38	58	133	41	2.0	5	( )a/	0.61
10/6/64	G	1410	33	8.6	25	60	33	20	0.4	2	(1.58)	"
10/6/64	G	1550	33	8.8	33	72	33	17	0.1	3	( )	"
10/7/64	G	0815	33	8.7	33	67	18	16	<0.1	6	( )a/	"
10/7/64	G	1000	33	8.6	28	72	13	11	<0.1	4	(1.74)	"
10/7/64	G	1330	33	8.6	30	67	16	16	<0.1	4	( )	"
10/8/64	G	0745	31	8.8	34	72	21	12	<0.1	3	( )a/	"
10/8/64	G	1000	32	9.0	31	57	38	13	0.3	6	(1.81)	"
10/8/64	G	1310	30	8.7	36	74	20	10	<0.1	8	( )	"
10/6/64 to 10/7/64	C	1000 1000	--	8.5	16	53	10	10	<0.1	3	--	0.61
10/8/64 to 10/9/64	C	1100 1100	--	8.9	49	69	16	12	<0.1	--	--	0.61

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a/ The numerical value represents a composite of the three grab samples.

UNITED FRYER AND STILLMAN, INC.
East 53rd Avenue and Franklin Street
Denver, Colorado

Date of Visit: Fall and Winter 1964 - 1965

Discussion: Brief information has been obtained on the nature of operations and the sources and magnitude of wastes from the United Fryer and Stillman, Inc. plant in Denver. The Company owns and operates a packinghouse. Cattle are received at the plant and major operations include animal slaughtering, processing of various meat products, and the rendering of blood, meat scraps and bone in producing valuable by-products. Approximately one-half acre of cattle holding pens are maintained by the establishment.

United Fryer and Stillman, Inc. in 1964 - 1965 provided no in-plant facilities for the removal of paunch manure and the entire paunch contents were discharged to the City of Denver sanitary sewers. Since that time, the Company has presumably initiated measures for recovering part of these solids within the plant. Holding pen manure is forwarded to the Race Court Fertilizer Company. Spent livestock drinking water and feedlot drainage seeps into the ground or otherwise reaches the South Platte River. The plant provides for grease removal from the process wastes prior to disposal. United Fryer and Stillman, Inc. discharges part of its process and rendering wastes, to which may be added spent cooling water and surface drainage, directly to the South Platte River at two locations. These outfalls are located 350 feet and 500 feet north of the Franklin Street bridge at RM 314.1. Sampling results showed one of discharges to have very high organic, solids, and bacterial concentrations, but however both flows were relatively small in magnitude. These wastes should be diverted from the River to the sanitary sewers in the very near future.

APPENDIX B - TABLE L

UNITED FRYER AND STILLMAN, INC.
DENVER, COLORADO
SAMPLING RESULTS

A) Discharge from 12-inch outfall to South Platte River 350 feet north of Franklin Street

Dates of Sampling	Type of Sample	Time	Temp C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Total Coliform MPN/100ml	Fecal Coliform MPN/100ml	ABS mg/1	Flow MGD
1/28/66	G	1040	22	6.4	130	2,810	18,600	1,354	1,120	8.0	13,000,000	7,900,000	2.5	<0.01

B) Discharge from 8-inch outfall to South Platte River 500 feet north of Franklin Street

1/28/66	G	1030	13	6.8	<5	24	273	12	9	<0.1	<1.8	--	0.1	0.02

WILSON AND COMPANY, INC.
4950 Washington Street
Denver, Colorado

Date of Visit: October 12, 1964

Persons Contacted: Charles Barbour, General Manager
Jack Priest, Plant Engineer

Discussion: Limited information was obtained on process operations and sources and magnitude of wastes from Wilson and Company, Inc., in a brief visit made to the establishment. Wilson and Company, Inc. owns and operates a slaughterhouse which includes cattle slaughtering and the trimming, washing, and cooling of carcasses. Recovered blood is sold to the Meinerz Blood Dehydrating Company. Meat scraps and bone are collected and shipped to the Denver Rendering Company. Wilson and Company, Inc. maintains approximately three-quarters of an acre of cattle holding pens.

Paunch manure is recovered by means of two settling tanks within the plant. Solids are disposed of to local farmers and the settled drainage is discharged to the Denver sanitary sewers. Manure from the holding pens is also removed by local farmers, and spent livestock drinking water and pen drainage are reportedly released to the Denver sanitary sewers. The Company provides in-plant grease removal facilities for process wastes entering the municipal sewers. Excess wastewater which enters the South Platte River at RM 314.9 directly under the cattle overpass, are reported to consist of spent cooling water, boiler blowdown, and some surface runoff.

APPENDIX B - TABLE LI

WILSON AND COMPANY, INC.
DENVER, COLORADO
SAMPLING RESULTS

Discharge from 6-inch outfall to South Platte River under cattle overpass

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Grease mg/1	Flow MGD
12/1/64	G	1020	--	7.7	--	--	445	7	3	< 0.1	--	0.04
12/1/64	G	1410	--	7.4	--	--	358	4	4	< 0.1	--	"
12/2/64	G	0750	--	7.4	6	--	404	25	11	<0.1	--	"
12/2/64	G	1140	--	7.5	--	--	390	7	3	< 0.1	--	"
12/3/64	G	1045	--	7.5	--	--	570	3	3	<0.1	--	"
12/3/64	G	1330	--	7.5	4	--	823	14	9	0.1	--	"
12/8/64	G	2305	--	7.4	7	72	439	112	27	0.5	--	"
12/1/64 to 12/2/64	C	1330 1330	--	7.4	4	--	450	4	3	<0.1	2	0.04
12/2/64 to 12/3/64	C	1330 1330	--	7.7	7	--	974	7	7	< 0.1	--	0.04

Appendix B - Table LII

Complete Listing and Description of Industrial Waste Sampling Stations

Denver Metropolitan Area

Station No.	Description	River Mileage
0001A	Waste flow into treatment lagoon from Gates Cyclo Poultry Farm	300.0/--
0001B	Treatment lagoon effluent from Gates Cyclo Poultry Farm to South Platte River	300.0
0002	Sand Creek sampled below Stapleton International Airport at railroad bridge located at extension of Smith Road and adjacent to Yosemite Street	312.1/4.9
0003	Sand Creek sampled above Stapleton International Airport at Havana Street	312.1/6.2
0004	Discharge from 10-inch outfall to ditch into South Platte River 700 feet south of York Street, from Capitol Rendering Company	313.5
0005	Effluent from Aurora Westerly sewage treatment plant into Westerly Creek	312.1/5.4/1.1
0006	Sand Creek sampled under North-South runway of the Stapleton International Airport	312.1/5.3
0007A	Drainage from kraut-house at Kuner Empson Company, Brighton, entering McCann Canal on south side of cabbage-house; waste sampled at beginning of open ditch after discharge of closed pipe flow into this ditch	---
0007B	Discharge from main plant at Kuner Empson Company, Brighton, crossing under cabbage-house and entering South Platte River; waste sampled at beginning of wooden flume after release of closed pipe flow into the flume	295.9
0007C	Waste effluent originating from pickle bins at Kuner Empson Company, Brighton, for ground seepage; sampled at end of pipe before discharge into open ditch	---
0008	Effluent from Packaging Corporation of America immediately after screens in concrete ditch on plant property and before discharge to South Platte River	313.3
0009	Twin 24-inch outfalls from Stapleton International Airport to Sand Creek adjacent to North-South Airport runway	312.1/5.3

Appendix B - Table LII (continued)
Complete Listing and Description of Industrial Waste Sampling Stations - Denver Metropolitan Area

Station No.	Description	River Mileage
0010	Discharge from Tenneco Oil Company to Sand Creek sampled in ditch approximately 30 yards from stream	312.1/0.9
0011	Discharge from Empire Petroleum Company (Conoco Asphalt Company) immediately before entering ditch leading to Sand Creek	312.1/1.1/0.05
0012	Discharge from twin 12-inch outfalls to South Platte River 120 yards north of railroad bridge at Elk Place, from Armour and Company	314.9
0013	Discharge from 10-inch galvanized pipe to South Platte River 160 yards north of railroad bridge at Elk Place, from Armour and Company	314.9
0014	Discharge from 12-inch outfall to South Platte River from Capitol Packing Company, downstream of cattle overpass and 400 yards south of main sewer trunk line crossover	314.8
0015	6-inch outfall from Wilson and Company intercepting South Platte River under cattle overpass	314.9
0016A	24-inch outfall from sheep pen area of Denver Union Stockyard Company, to South Platte River 10 feet north of cattle overpass	314.8
0016B	24-inch outfall from hog pen area of Denver Union Stockyard Company, to South Platte River 300 yards south of main sewer trunk line crossover	314.8
0017A	Discharge from Swift and Company sampled at manhole 40 feet inside main gate in Company parking area on line leading to storm sewer to South Platte River; storm sewer originates from south cattle feed pens of the Denver Union Stockyard Company and intercepts River 100 yards south of cattle overpass	314.9/--
0017B	24-inch outfall from north cattle pen area of Denver Union Stockyard Company, sampled at manhole on property of Race Court Fertilizer Company, to South Platte River 100 yards north of main sewer trunk line crossover	314.4
0019	Discharge from 8-inch tile outfall to South Platte River 50 yards north of 23rd Street, from 23rd and Fox Street maintenance shops of the Colorado, Burlington and Quincy Railroad sampled at far end of settling chamber	316.6

Appendix B - Table LII (continued)
Complete Listing and Description of Industrial Waste Sampling Stations - Denver Metropolitan Area

Station No.	Description	River Mileage
0019A	Discharge from 24-inch outfall to South Platte River at W. Moncrieff Place railroad bridge, from 23rd and Fox Street maintenance shops of the Colorado, Burlington and Quincy Railroad	316.8
0020	Discharge from 72-inch outfall to South Platte River at 7th Avenue from Denver and Rio Grande Western Railroad	319.7
0021A	Cyanide plating wastes from Shwayder Brothers Inc., sampled in cyanide plating room in concrete trough before mixing with chrome plating wastes; these wastes discharge to plant sewer leading to Mississippi Avenue storm sewer	322.3/--
0021B	Spent cooling waters from Shwayder Brothers Inc., sampled inside plant (in southwest area) in concrete trough; these waters discharge to plant sewer leading to Mississippi Avenue storm sewer	322.3/--
0021C	Paint-stripping wastes from Shwayder Brothers Inc., sampled from sump in the paint stripping building on east side of plant area; these wastes discharge to plant sewer leading to Mississippi Avenue storm sewer	322.3/--
0021E	Chrome plating wastes from Shwayder Brothers Inc., sampled from collection sump in chrome plating room; these wastes discharge to plant sewer leading to Mississippi Avenue storm sewer	322.3/--
0022A	South Platte River water intake sampled at intake box to General Chemical Division plant, Allied Chemical Corporation	320.9
0022B	Line 1 - Absorbing acid cooling water effluent to South Platte River from General Chemical Division plant, Allied Chemical Corporation	320.8
0022C	Line 2 - Drying and cooling water effluent to South Platte River from General Chemical Division plant, Allied Chemical Corporation	320.8
0022E	Line 4 - Oleum cooling water effluent to South Platte River from General Chemical Division plant, Allied Chemical Corporation	320.7
0022F	Line 5 - Dry acid absorbing cooling water effluent to South Platte River from General Chemical Division plant, Allied Chemical Corporation	320.6

Appendix B - Table LII (continued)
Complete Listing and Description of Industrial Waste
Sampling Stations - Denver Metropolitan Area

Station No.	Description	River Mileage
0022G	Line 6 - Downdraft cooling water effluent to South Platte River from General Chemical Division plant, Allied Chemical Corporation	320.6
0023A	Sewer No. 1 from Gates Rubber Company, sampled at manhole directly east of Acoma Street--Kentucky Avenue Company gate and inside Company fence-line, before discharge to Kentucky Avenue storm sewer	321.8/--
0023B	Sewer No. 5 from Gates Rubber Company, sampled at manhole directly east of railroad approximately 10 feet north of Company fence-line and inside Company gate, before discharge to Mississippi Avenue storm sewer	322.3/--
0023C	Sewer No. 6 from Gates Rubber Company, sampled at manhole approximately 150 feet east of railroad and 15 feet north of Company fence-line, before discharge to Mississippi Avenue storm sewer	322.3/--
0023D	Sewer No. 8 from Gates Rubber Company, sampled at manhole on W. Tennessee Avenue and 15 feet north of time-card building, before discharge to Mississippi Avenue storm sewer	322.3/--
0024	Discharge from 12-inch outfall to Burlington-O'Brian Canal from Continental Oil Company	314.2/1.1
0032	Discharge from 6x8-inch outfall 150 yards north of 7th Street, to South Platte River from the Colorado and Southern Railroad	318.1
0032A	Discharge from wooden outfall 50 yards north of 7th Street, to South Platte River from the Colorado and Southern Railroad	318.1
0033	Discharge from 24-inch outfall 150 yards south of 7th Street, to South Platte River from the Colorado and Southern Railroad	318.2
0034	Discharge from 8-inch outfall 250 yards south of 7th Street, to South Platte River from the Colorado and Southern Railroad	318.2
0037A	Spent coolant water discharges leaving E. I. DuPont de Nemours and Company plant in Louviers, Colorado, sampled within discharge ditch leading to Plum Creek	335.5/6.3/0.2
0037B	Process wastes immediately before discharge to industrial waste pond at the E. I. DuPont de Nemours and Company plant in Louviers, Colorado	335.5/6.3/--

Appendix B - Table LII (continued)
Complete Listing and Description of Industrial Waste
Sampling Stations - Denver Metropolitan Area

Station No.	Description	River Mileage
0038A	Waste discharge from Coors Porcelain Company, sampled at manhole on south side of building immediately south of fence-line, before discharge to Tucker Gulch	311.1/16.1/0.3
0038B	Clear Creek sampled upstream of Adolph Coors Company and Coors Porcelain Company at Ford Street bridge in Golden	311.1/16.2
0038C	Clear Creek sampled approximately 200 yards downstream of Adolph Coors Company sewage treatment plant	311.1/15.8
0040	Combined treated effluents including test-area wastes, plating wastes, and domestic sewage from the Martin Company, sampled in Brush Creek, at bridge on gravel road traveling from Martin Company to Kassler, southeast of plant	341.1/2.0
0041A	Discharge from 18-inch outfall to South Platte River 500 yards north of York Street, from Litvak Meat Company	312.8
0041B	Discharge from 8-inch outfall to South Platte River 550 yards north of York Street, from Litvak Meat Company	312.8
0042	18-inch outfall from the Arapahoe plant of the Public Service Company of Colorado to the South Platte River upstream of West Evans Avenue	325.1
0043A	42-inch outfall from the Cherokee plant of the Public Service Company of Colorado to the South Platte River 730 yards south of Sand Creek confluence	312.5
0043B	24-inch outfall from the Cherokee plant of the Public Service Company of Colorado to the South Platte River 700 yards south of Sand Creek confluence	312.5
0044A	24-inch outfall from fly-ash lagoon of the Zuni plant of the Public Service Company of Colorado to the South Platte River 100 feet south of 13th Avenue	319.1
0044B	2x4-foot outfall from the Zuni plant of the Public Service Company of Colorado to the South Platte River 120 feet north of 13th Avenue, sampled at end of concrete sluice box	319.1
0044C	16-inch outfall from the Zuni plant of the Public Service Company of Colorado to the South Platte River 130 feet north of 13th Avenue	319.1

Appendix B - Table LII (continued)
Complete Listing and Description of Industrial Waste
Sampling Stations - Denver Metropolitan Area

Station No.	Description	River Mileage
0045A	8-inch outfall from United Fryer and Stillman, Inc., to South Platte River 500 feet north of Franklin Street bridge	314.1
0045B	12-inch outfall from United Fryer and Stillman, Inc., to South Platte River 350 feet north of Franklin Street bridge	314.1
0046	Ditch outlet, from settling pond of the Colorado School of Mines Research Foundation, Inc., 900 yards west of Washington Avenue, Golden, into Clear Creek	311.1/16.4

REMAINDER OF BASIN

CARNATION COMPANY
Johnstown, Colorado

Date of Visit: June 24, 1965

Person Contacted: H. S. Meyers, Plant Manager

Process and Operation: The Johnstown plant of the Carnation Company processes, packages, and distributes evaporated milk. About 75 percent of the raw milk is received in tank cars from surrounding dairies, and the remainder in 10 gallon cans from local farmers.

The plant normally operates 12 hours a day, 7 days a week, with an average of 30 employees. However, at times, there is 24-hour operation utilizing up to 40 persons.

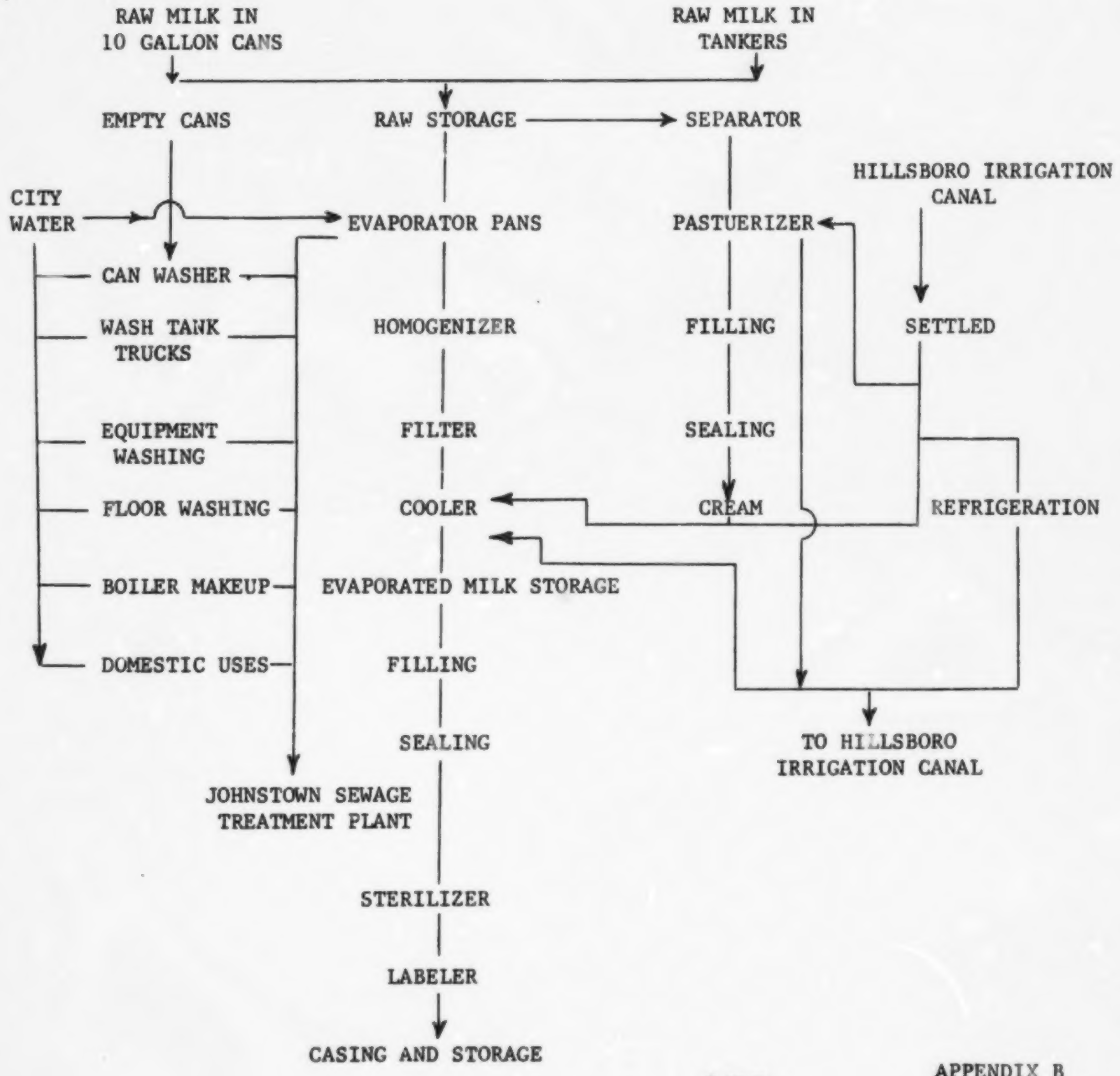
Sources and Uses of Water: Plant water supply is obtained from the City of Johnstown and the Hillsboro Irrigation Canal. City water amounting to 2.5 million gallons per month is used for all processing where there is contact with milk, for domestic purposes, and boiler makeup. Canal water is utilized at the average rate of 400 gallons per minute for the cooling and refrigeration of milk.

Sources and Characteristics of Wastes: Major in-plant wastes originate from the cleaning of equipment and milk spillage, and consist largely of wasted milk solids.

Treatment and Disposal of Wastes: All waste effluents from the plant are discharged to the City of Johnstown municipal sewers with the exception of spent cooling waters. The spent cooling waters are released into the Hillsboro Canal. There is no in-plant waste treatment.

CARNATION COMPANY
JOHNSTOWN, COLORADO

FLOW SHEET FOR EVAPORATED MILK


RAW MILK IN 10 GALLON CANS
RAW MILK IN TANKERS
EMPTY CANS
RAW STORAGE
SEPARATOR
HILLSBORO IRRIGATION CANAL
CITY WATER
EVAPORATOR PANS
PASTUERIZER
CAN WASHER
WASH TANK TRUCKS
HOMOGENIZER
FILLING
SETTLED
EQUIPMENT WASHING
FILTER
SEALING
FLOOR WASHING
COOLER
CREAM
REFRIGERATION
BOILER MAKEUP
EVAPORATED MILK STORAGE
DOMESTIC USES
FILLING
SEALING
TO HILLSBORO IRRIGATION CANAL
JOHNSTOWN SEWAGE TREATMENT PLANT
STERILIZER
LABELER
CASING AND STORAGE

APPENDIX B
FIGURE 8

APPENDIX B - TABLE LIII

CARNATION COMPANY
JOHNSTOWN, COLORADO
SAMPLING RESULTS

Waste effluent into Hillsboro Canal

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Total Coliform MPN/100ml	Fecal Coliform MPN/100ml	Flow MGD
5/16/66	G	1500	43	7.9	6	24	65	11	<0.1	11,000	2,300	0.36
5/18/66	G	0930	13	7.5	7	18	4	2	0.2	33,000	1,700	0.11

CYCLONE FILTER DIVISION
GOULD NATIONAL BATTERIES, INC.
120 East 9th Avenue
Longmont, Colorado

Date of Visit: June 22, 1965

Persons Contacted: John A. Peterson, Plant Manager
Ray Lee, Plant Superintendent
E. T. Nakagawa, Controller

Process and Operation: The Longmont plant of the Cyclone Filter Division, Gould National Batteries provides the final steps in manufacture of oil, air, and fuel filters. Paper and cotton fillers are stamped and inserted into steel assemblies which are then sealed. The plant operates on a day-shift of 8 hours, 5 days a week with 200 employees. Forty-five persons are utilized on the night shift for maintenance operations.

Sources and Uses of Water: Plant water supply is obtained entirely from the City of Longmont. Total water consumption averages around 350,000 gallons per month and is used for domestic purposes, cooling of the welders, washing of filter shells, air conditioning, and boiler makeup.

Sources and Characteristics of Wastes: Process wastes originate from the washing of filter shells and spent cooling water from the welding units. The washings containing a water soluble oil, are discarded every 2 or 3 days.

Treatment and Disposal of Wastes: Sanitary wastes amounting to 100,000 gallons per month are directed to the City of Longmont sanitary sewers. All remaining plant wastes approximating 250,000 gallons per month are discharged into a drainage ditch which then flows into St. Vrain Creek.

APPENDIX B - TABLE LIV

CYCLONE FILTER DIVISION
GOULD NATIONAL BATTERIES, INC.
LONGMONT, COLORADO
SAMPLING RESULTS

A) Waste discharge from North Plant into drainage ditch

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Total Coliform MPN/100ml	Fecal Coliform MPN/100ml	Flow MGD
5/16/66	G	0945	36	9.0	5	82	47	12	<0.1	<1.8	--	<0.01
5/17/66	G	1000	43	10.6	9	145	20	9	<0.1	<1.8	--	0.06
5/18/66	G	0845	34	6.7	1	14	52	11	<0.1	<1.8	--	<0.01

B) Waste discharge from South Plant into drainage ditch

5/16/66	G	0945	16	7.0	<1	4	1	1	<0.1	4.5	2.0	<0.01
5/17/66	G	1000	15	7.3	<1	6	<1	<1	<0.1	<1.8	--	<0.01
5/18/66	G	0845	15	6.7	1	10	1	1	<0.1	<1.8	--	<0.01

KUNER EMPSON COMPANY
Longmont, Colorado

Date of Visit: May 4, 1965

Persons Contacted: William C. Kunzmann, Production Manager
W. C. Beisner, Assistant Production Manager
Clark Saul, Foreman

Process and Operation: This establishment is a vegetable cannery handling peas, red beets, potatoes, carrots, pumpkin, kidney beans, pinto beans and hominy (corn). Various amounts of salts, sugar and spices are used as essential ingredients in various combination depending upon the final product desired. The operations may be classed as seasonal although certain activities are carried out on a year-around basis. The same equipment is more or less adaptable and used for canning of all products. The canning schedule at the Longmont plant is approximately as follows:

Peas:	June 15 to July 15
Red beets:	July 25 to September 10
Potatoes:	Major part from September 10 to October 10; some potatoes processed August 1 to September 10 and October 10 to January 1
Pumpkins:	October 10 to November 5
Carrots:	November 10 to November 15
Red kidney beans, pinto beans and hominy	November 15 to May 1 (the following year)

Basic process operations consist of 1) removing extraneous and nonedible matter in preparatory steps such as shelling, clipping, hulling, stem-removal, cutting, washing and grading; 2) blanching, peeling and additional washing; and 3) filling and sealing of cans, cooking, brining, pulping, retorting, cooling and storage.

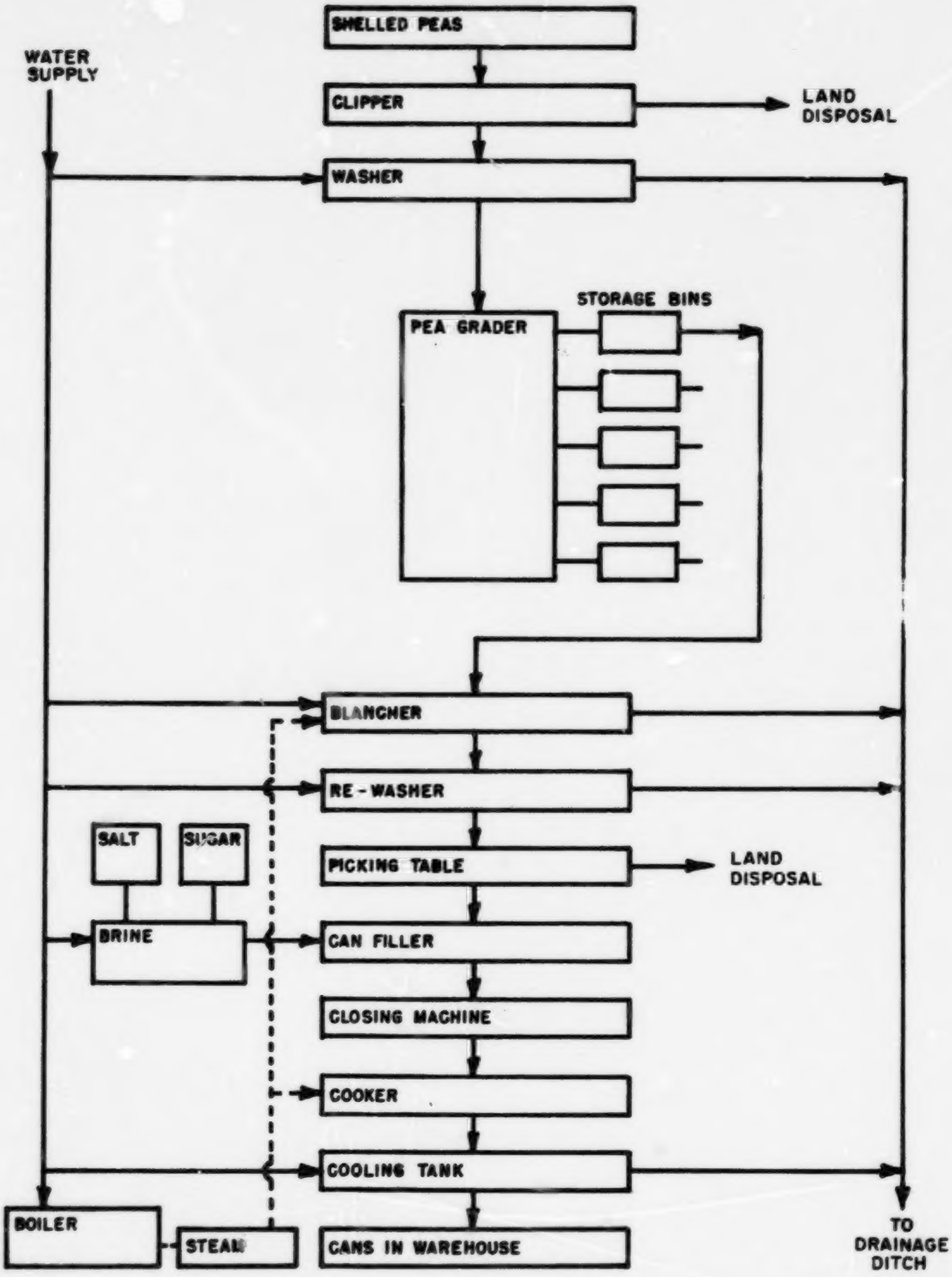
During the heavy canning period of June 15 to November 15, the plant operates 10 to 12 hours per day with 150 employees. Fifteen full-time employees are present during the remaining 7 months.

Sources and Uses of Water: Total plant water supply is obtained from the City of Longmont. Records show that 26.3 million gallons of City water was used by the plant during the year 1964.

Sources and Characteristics of Wastes: Process waste waters originate from fluming, washing, peeling, hulling, equipment and floor washing, pasteurization, cooking, canning, spent brines, and ensilage of discarded vegetable matter stored on the plant grounds. These liquid wastes are high in organic content, coarse and dissolved solids, and color. The solids which are allowed to accumulate on the plant grounds consist mainly of pea vines.

Treatment and Disposal of Wastes: All plant wastes excluding domestic sewage are released to the drainage ditch crossing the plant property which then flows about one-half mile and enters St. Vrain Creek. Domestic wastes are directed to the Longmont sanitary sewers. A short distance below the plant the entire flow of the drainage ditch passes through a 12-mesh screen installed by the Company for the purpose of removing extraneous solids in the effluent waste. The screenings are removed by a cup conveyor to a storage tank and eventually used for hog feed or landfill. Screening represents the only treatment afforded plant wastes and this operation has often proved to be ineffective in removing even the gross solids. The Company plans no change in their waste disposal and treatment facilities.

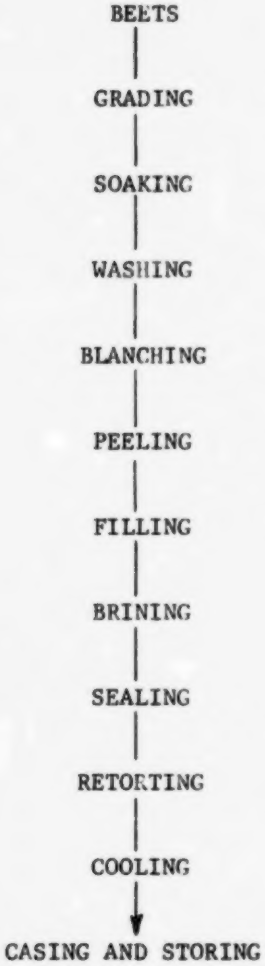
KUNER EMPSON COMPANY
LONGMONT, COLORADO
FLOW SHEET FOR PEA CANNING


SHELLED PEAS
WATER SUPPLY
CLIPPER
LAND DISPOSAL
WASHER
STORAGE BINS
PEA GRADER
BLANCHER
RE-WASHER
SALT
SUGAR
PICKING TABLE
LAND DISPOSAL
BRINE
CAN FILLER
CLOSING MACHINE
COOKER
COOLING TANK
BOILER
STEAM
CANS IN WAREHOUSE
TO DRAINAGE DITCH

APPENDIX B
FIGURE 9

KUNER EMPSON COMPANY
LONGMONT, COLORADO

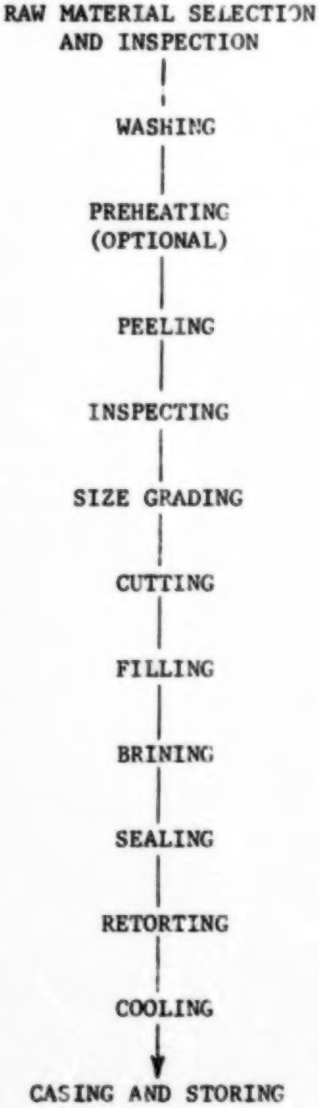
PROCESS LINE DIAGRAM FOR RED BEET CANNING


BEETS
GRADING
SOAKING
WASHING
BLANCHING
PEELING
FILLING
BRINING
SEALING
RETORTING
COOLING
CASING AND STORING

APPENDIX B
FIGURE 10

KUNER EMPSON COMPANY
LONGMONT, COLORADO

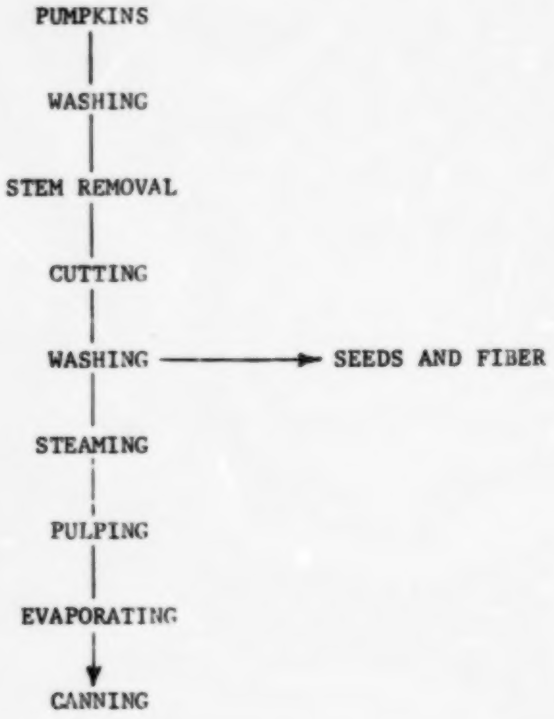
PROCESS LINE DIAGRAM FOR POTATO AND CARROT CANNING


RAW MATERIAL SELECTION AND INSPECTION
WASHING
PREHEATING (OPTIONAL)
PEELING
INSPECTING
SIZE GRADING
CUTTING
FILLING
BRINING
SEALING
RETORTING
COOLING
CASING AND STORING

APPENDIX B
FIGURE 11

KUNER EMPSON COMPANY
LONGMONT, COLORADO

PROCESS LINE DIAGRAM FOR PUMPKIN CANNING


PUMPKINS
WASHING
STEM REMOVAL
CUTTING
WASHING
SEEDS AND FIBER
STEAMING
PULPING
EVAPORATING
CANNING

APPENDIX B
FIGURE 12

KUNER EMPSON COMPANY
LONGMONT, COLORADO

PROCESS LINE DIAGRAM FOR HOMINY (CORN) CANNING

CORN (YELLOW OR WHITE)
SHELLING
WASHING
HULLING
WASHING
BOILING
BRINING
SEALING
RETORTING
COOLING
CASING AND STORING

APPENDIX B
FIGURE 13

APPENDIX B - TABLE LV

KUNER EMPSON COMPANY
LONGMONT, COLORADO
SAMPLING RESULTS

Drainage ditch immediately above plant

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Cl mg/1	NO_3N mg/1	ABS mg/1	Flow MGD
6/29/65	G	0940	15.0	7.0	8	17	1430	28	7	0.2	5.5	1.53	0.1	1.41
6/29/65	G	1110	18.0	7.8	18	27	1260	32	8	0.1	4.5	1.38	1.4	"
6/30/65	G	0945	17.0	8.0	--	21	995	63	26	<0.1	3.5	--	--	"
6/30/65	G	1130	19.0	8.0	--	27	840	85	19	0.1	4.0	--	--	"
7/1/65	G	0940	15.0	8.0	<2	5	1740	--	--	<0.1	10	--	--	"
7/1/65	G	1115	18.0	8.2	2	2	1680	--	--	<0.1	9.5	--	--	"
7/12/65	G	1015	17.0	7.8	9	10	1620	31	4	<0.1	--	--	--	"
7/13/65	G	1010	16.5	4.3	10	13	1400	24	8	<0.1	--	--	--	"
7/14/65	G	0905	15.5	8.1	<4	11	1590	16	8	<0.1	--	--	--	"
7/14/65	G	1140	18.5	8.2	<4	12	1620	11	4	<0.1	--	--	--	"
7/15/65	G	0945	16.0	8.2	4	8	1520	3	3	<0.1	--	--	--	"
6/29/65 to 6/30/65	C	0945 0945	--	8.0	--	17	1040	12	8	<0.1	4.0	--	--	1.41
6/30/65 to 7/1/65	C	1000 1000	--	7.9	6	12	1220	--	--	<0.1	6.5	--	--	1.41
7/13/65 to 7/14/65	C	0910 0910	--	8.2	4	9	1690	4	3	<0.1	--	--	--	1.41
7/14/65 to 7/15/65	C	0950 0950	--	8.4	<4	10	1690	1	1	<0.1	--	--	--	1.41

APPENDIX B - TABLE LVI

KUNER EMPSON COMPANY
LONGMONT, COLORADO
SAMPLING RESULTS

Drainage ditch immediately below vibrating screen and above pea vine drainage

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Cl mg/1	NO_3N mg/1	ABS mg/1	Flow MGD
6/29/65	G	0945	15.0	8.0	190	218	4180	41	17	0.1	1090	1.15	--	1.95
6/29/65	G	1120	18.5	8.1	330	292	1580	46	25	0.1	220	1.13	--	"
6/30/65	G	1110	20.0	7.8	220	218	1230	64	24	0.2	164	--	--	"
7/1/65	G	1010	16.0	8.0	<18	69	1700	--	--	0.2	22	--	--	"
7/1/65	G	1110	18.0	8.2	<18	12	1630	--	--	<0.1	38	--	--	"
7/12/65	G	1030	21.5	6.3	320	314	2970	47	19	0.1	--	--	--	"
7/13/65	G	1045	20.0	7.3	240	242	2070	53	32	0.5	--	--	--	"
7/14/65	G	0915	19.0	6.2	285	318	2420	29	20	<0.1	392	--	--	"
7/14/65	G	1135	20.5	6.3	>67	293	2390	27	16	<0.1	--	--	--	"
7/15/65	G	1010	22.0	8.0	340	318	3440	31	25	0.2	--	--	--	"
6/28/65 to 6/29/65	C	1400 0900	--	7.6	100	79	1700	45	32	<0.1	200	0.28	0.2	1.95
6/29/65 to 6/30/65	C	0950 0950	--	7.0	114	83	1480	26	22	<0.1	156	--	--	1.95
6/30/65 to 7/1/65	C	1000 1000	--	7.4	120	79	1400	--	--	<0.1	98	--	--	1.95
7/13/65 to 7/14/65	C	0940 0940	--	7.3	<64	74	2290	40	35	<0.1	383	--	--	1.95
7/14/65 to 7/15/65	C	1010 1010	--	7.4	160	102	2370	39	33	<0.1	--	--	--	1.95

APPENDIX B - TABLE LVII

KUNER EMPSON COMPANY
LONGMONT, COLORADO
SAMPLING RESULTS

Drainage ditch below vibrating screen and below pea vine drainage

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Cl mg/1	NO_3N mg/1	ABS mg/1	Flow MGD
6/29/65	G	0955	17.0	7.8	190	220	4180	26	14	0.2	940	0.38	--	1.95
6/29/65	G	1115	20.0	7.7	460	432	1660	56	25	0.1	205	1.74	--	"
6/30/65	G	0955	18.0	7.6	230	194	1500	48	17	0.1	204	--	--	"
6/30/65	G	1110	20.0	7.6	235	212	1270	--	--	0.4	156	--	--	"
7/1/65	G	1000	16.0	7.8	96	70	1680	--	--	<0.1	12	--	--	"
7/1/65	G	1110	18.5	7.8	110	87	1810	--	--	<0.1	40	--	--	"
7/12/65	G	1035	22.0	5.9	445	420	4120	49	23	<0.1	--	--	--	"
7/13/65	G	1100	20.5	7.8	365	349	2730	44	34	0.6	--	--	--	"
7/14/65	G	0920	20.0	6.0	445	430	2630	36	28	<0.1	392	--	--	"
7/14/65	G	1130	22.0	6.0	415	668	2960	44	34	<0.1	530	--	--	"
7/15/65	G	1020	21.0	7.2	490	472	4220	48	37	0.3	--	--	--	"
6/28/65 to 6/29/65	C	1400 1000	--	7.4	155	125	1800	53	16	<0.1	210	1.01	0.2	1.95
6/29/65 to 6/30/65	C	0955 0955	--	7.1	180	117	1490	154	118	<0.1	556	--	--	1.95
6/30/65 to 7/1/65	C	1000 1000	--	7.2	120	68	1540	--	--	<0.1	94	--	--	1.95
7/13/65 to 7/14/65	C	0930 0930	--	6.8	240	193	2510	46	46	<0.1	289	--	--	1.95
7/14/65 to 7/15/65	C	1020 1020	--	6.9	285	214	2550	45	40	<0.1	--	--	--	1.95

APPENDIX B - TABLE LVIII

KUNER EMPSON COMPANY
LONGMONT, COLORADO
SAMPLING RESULTS

Drainage ditch near mouth

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Cl mg/1	NO_3N mg/1	ABS mg/1	Flow MGD
6/9/65	G	1325	18.5	8.8	13	18	1,340	10	6	<0.1	--	--	0.1	1.51
6/22/65	G	1140	22.0	8.2	275	285	3,850	137	48	0.4	940	3.49	0.3	"
6/23/65	G	1015	16.5	7.8	118	121	1,630	28	12	0.2	18	1.59	0.2	"
6/24/65	G	1410	21.0	7.6	350	447	2,570	74	37	0.2	560	4.52	0.5	"
6/25/65	G	1045	21.0	7.4	515	626	3,080	52	50	0.2	630	0.92	0.5	"

APPENDIX B - TABLE LIX

KUNER EMPSON COMPANY
LONGMONT, COLORADO
SAMPLING RESULTS

Pea vine drainage

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Flow MGD
6/29/65	G	0955	28.0	3.9	>16,500	48,600	19,000	478	78	0.2	<0.01
7/1/65	G	1020	30.5	4.0	63,000	49,400	19,250	--	--	1.8	"
7/12/65	G	1030	33.0	4.2	>65,500	>49,400	21,400	3,600	2,280	5.0	"
7/13/65	G	1040	30.0	7.9	>66,500	>99,500	21,300	2,630	1,870	10.0	"
7/15/65	G	1000	31.0	4.4	57,500	69,900	23,000	75	70	0.3	"

LOWELL-PAUL DAIRY
Route 2
Greeley, Colorado

Date of Visit: April 23, 1965

Person Contacted: Mr. Alton Paul

Process and Operation: The Lowell-Paul Dairy processes, packages and delivers milk, cream, and ice cream on a home delivery basis. Raw milk intake by the plant averages 36,000 pounds per week. The plant has limited storage facilities and processing operations approximate only 12 hours per week.

Sources and Uses of Water: The plant obtains its entire water supply, amounting to about 10,000 gallons per week, from a single well located on the company property. Water supply is primarily used for cleaning of equipment with lesser amounts for boiler makeup, cooling and sanitary facilities.

Sources and Characteristics of Wastes: The waste effluents from the Lowell-Paul Dairy are representative of milk processing establishments experiencing milk solids lost during operation. Wastes are derived principally from the cleaning of equipment and from spillage.

Treatment and Disposal of Wastes: Plant processing wastes are discharged into two settling tanks, 750 gallons and 200 gallons, connected in series. The overflow enters the Greeley No. 3 Canal. On April 23, 1965, the waste discharge to the canal was noted as clear although some floating solids were present on the canal waters near the outfall.

APPENDIX B - TABLE LX

LOWELL-PAUL DAIRY
GREELEY, COLORADO
SAMPLING RESULTS

Greeley No. 3 Canal immediately above plant outfall

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Total Coliform MPN/100ml	Fecal Coliform MPN/100ml	ABS mg/1
5/25/65	G	1210	12.0	8.2	15	56	771	388	67	1.4	33,000	7,800	0.2
5/25/65	G	1300	12.0	8.2	17	--	777	271	52	1.2	33,000	23,000	0.1
6/2/65	G	1115	15.0	8.9	11	18	1800	30	29	<0.1	11,000	3,100	0.1
6/3/65	G	1145	16.0	8.1	16	16	1770	--	--	<0.1	4,900	1,700	0.1
6/3/65	G	1310	17.5	8.3	4	16	1750	16	6	<0.1	14,000	4,600	0.2

APPENDIX B - TABLE LXI

LOWELL-PAUL DAIRY
GREELEY, COLORADO
SAMPLING RESULTS

Greeley No. 3 Canal below plant outfall

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Total Coliform MPN/100ml	Fecal Coliform MPN/100ml	ABS mg/1
5/25/65	G	1210	12.0	8.5	16	51	770	461	62	1.3	26,000	<1,800	0.1
5/25/65	G	1300	12.0	8.2	<9	--	770	346	50	1.4	70,000	7,800	0.1
6/2/65	G	1145	16.0	8.9	16	18	1690	19	8	<0.1	22,000	2,300	0.1
6/3/65	G	1150	16.5	8.2	5	20	1770	26	10	0.1	7,000	4,600	0.2
6/3/65	G	1310	17.5	8.3	6	19	1750	17	7	<0.1	18,000	4,500	0.2

MONFORT PACKING COMPANY
Greeley, Colorado

Date of Visit: October 13, 1964

Persons Contacted: Ken Monfort, President
Burke Hurt
Tom Jelsma
Vern Nelson, Consulting Engineer of the Firm of Nelson, Halley, Patterson and Quirk, Greeley, Colorado

Process and Operation: The Monfort Packing Company is one of the largest packinghouses in the South Platte River Basin. The Company maintains its own cattle feedlot which holds in excess of 50,000 head. Both cattle and lambs are received into the plant and the unit operations comprise slaughtering, dressing of carcasses, and rendering of viscera, meat scraps and bones. In a 12 month period, the plant receives 225,000 cattle and 450,000 lambs for slaughter which represents 20 percent of the total cattle and 25 percent of the total lambs processed within the State of Colorado. Paunch manure is screened and removed for land fertilizer. The blood is separated and sold to the Meinerz Blood Dehydrating Company in Denver, Colorado.

The processing plant and office facilities utilize 285 employees. By the end of 1965, this number is expected to increase to 385. Processing plant personnel normally work about 9 hours per day, 5 days each week.

Sources and Uses of Water: Plant water supply is obtained both from the City of Greeley and from two Company wells. Each well is rated between 800 and 1,000 gpm. In late 1964, only one of the two wells was in use.

City water is employed for edible processing, boiler makeup, sanitary facilities, laundry and cleanup. Well water serves the needs of cooling and refrigeration, brining, and inedible rendering.

Sources and Characteristics of Wastes: Major wastes comprise washings from carcass and equipment, drainage from the paunch manure screening and from the hide cellar, floor and equipment cleanup waters, condensed vapors from the rendering cookers, and wastewater from the plant laundry. Large quantities of blood present in the waste effluents from the plant indicate that blood recovery practices were far from adequate.

Treatment and Disposal of Wastes: At the time of the plant visit in October 1964 and also during the sampling survey of May 1965, processing effluents were discharged to the Cache la Poudre River at two separate points. Spent cooling water and the liquors drained from the paunch manure were passed through a 12x18-foot grease recovery tank and then released directly to the River at RM 7.1. Remaining plant wastes including large amounts of washdown wastes, excess blood, laundry and domestic wastes and other were pumped to a lift station box on the Greeley sewerage system across the river from the packing Company. However, the lift station was tremendously undersized in respect to hydraulic capacity. A by-pass provided in the structure allowed the large majority of wastes entering the station to be consequently dumped into the river at RM 7.2. These wastes in very large part originated from the Monfort Packing Company.

On August 3, 1965, a visit was made to the Greeley sewage treatment plant. City officials stated that all processing wastes from the Monfort Packing had been recently accepted into a new interceptor sewer line leading to the newly-enlarged municipal treatment plant. Assurance was given that all previous waste discharges to the river in the vicinity of the packinghouse had been eliminated.

APPENDIX B - TABLE LXII

MONFORT PACKING COMPANY
GREELEY, COLORADO
SAMPLING RESULTS

Direct waste flow from processing plant

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Total Coliform MPN/100ml	Fecal Coliform MPN/100ml	Flow MGD
5/18/65	G	0645	19.0	7.3	6	15	1810	1	1	<0.1	130,000	33,000	1.0
5/18/65	G	1240	38.0	7.2	850	1330	1670	604	576	10	3,300,000	3,300,000	"
5/19/65	G	0750	23.0	7.4	825	1380	1730	792	744	15	230,000	230,000	"
5/19/65	G	1130	40.0	7.6	1250	1670	1800	1540	1470	21	1,100,000	700,000	"
5/19/65	G	1420	42.5	7.4	410	595	1860	246	246	0.4	490,000	490,000	"
5/20/65	G	1140	34.0	7.4	925	1170	1780	--	--	14	230,000	230,000	"
5/20/65	G	1420	42.0	7.2	1075	1380	1540	828	800	16	330,000	330,000	"
5/18/65	C	0730 to 1630	--	7.5	1990	1190	2490	1020	1010	9.0	--	--	0.44 MG
5/18/65 to 5/19/65	C	1630 0730	--	7.6	215	188	1780	144	113	1.3	--	--	0.56 MG
5/19/65	C	0730 to 1630	--	7.3	1050	1630	1880	996	916	10.0	--	--	0.44 MG
5/19/65 to 5/20/65	C	1630 0730	--	7.8	145	132	2060	--	--	0.1	--	--	0.56 MG
5/20/65	C	0730 to 1630	--	7.4	--	1240	1540	784	724	13.0	--	--	0.44 MG
5/20/65 to 5/21/65	C	1630 1000	--	7.8	460	1160	1560	49	47	1.5	--	--	0.76 MG

Total time of sampling = 3 days, 2 and one-half hours

Average daily flow = 1.00 MGD of which

0.44 MG occurs 0730 through 1630 and 0.56 MG from 1630 through 0730

APPENDIX B - TABLE LXIII

MONFORT PACKING COMPANY
GREELEY, COLORADO
SAMPLING RESULTS

Bypass from lift station on Greeley sewer line at 8th Avenue (predominately Monfort Company wastes)

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Total Coliform MPN/100ml	Fecal Coliform MPN/100ml	Flow MGD
5/18/65	G	0640	23.0	7.4	2250	2280	55,300	1120	820	5.0	17,000,000	11,000,000	0.87
5/18/65	G	1235	28.0	9.2	1790	1640	11,000	507	464	1.1	1,700,000	1,300,000	"
5/19/65	G	0800	27.0	8.5	1820	1860	15,400	496	440	2.3	7,900,000	4,900,000	"
5/19/65	G	1115	29.0	8.0	1300	1660	2,990	472	--	2.5	4,900,000	1,700,000	"
5/19/65	G	1545	28.5	8.8	1400	1760	2,970	316	--	8.0	--	--	"
5/19/65	G	1350	31.5	--	--	--	--	--	--	--	2,200,000	2,200,000	"
5/20/65	G	1145	29.0	8.1	1100	1830	10,600	--	--	2.5	4,600,000	3,600,000	"
5/20/65	G	1445	28.5	9.0	1275	1550	5,060	508	508	1.6	1,100,000	700,000	"
5/21/65	G	1100	26.0	8.2	1300	1270	2,950	352	316	4.5	--	--	"
5/18/65	C	0730 to 1630	--	8.9	1550	2500	14,700	1980	936	0.7	--	--	0.38 MG
5/18/65 to 5/19/65	C	1630 0730	--	8.2	1320	2280	31,900	1860	1790	4.2	--	--	0.49 MG
5/19/65	C	0730 to 1630	--	9.0	1420	1400	13,500	594	564	1.8	--	--	0.38 MG
5/19/65 to 5/20/65	C	1630 0730	--	7.9	--	1010	8,670	--	--	2.5	--	--	0.49 MG
5/20/65	C	0730 to 1630	--	8.0	1375	1770	7,600	1600	1580	1.5	--	--	0.38 MG

Total time of sampling = 2 days, 9 hours

Average daily flow = 0.87 MGD of which 0.38 MG occurs 0730 through 1630 and 0.49 MG from 1630 through 0730

WELD COUNTY BI-PRODUCTS COMPANY
Greeley, Colorado

Date of Visit: April 23, 1965

Person Contacted: Lee Merrick

Process and Operation: The Weld County Bi-Products Company operates a slaughterhouse converting beef into dog-food products. The plant receives cattle that have succumbed during holding at various feedlots and slaughterhouses. An average of 15 cattle are handled per day and the establishment operates 7 days a week.

Sources and Uses of Water: Total plant water supply is obtained from the North Weld County Water District, Windsor, Colorado, and approximates 15,000 gallons per day. This water supply is used for carcass washing, cleanup, boiler makeup and cooling purposes.

Sources and Characteristics of Wastes: Major plant wastes originate from carcass washing, and cleanup of equipment and floors. Minor wastes are derived from the preparation of by-products.

Treatment and Disposal of Wastes: All plant wastes including blood, offal, grease and other spent products together with domestic sewage are discharged into a three-compartment septic tank. The effluents from the septic tank are released into a natural seep drain which crosses the plant property and eventually reaches the Cache la Poudre River. The septic tank on April 23, 1965 was not functioning properly because of a large accumulation of solids within the tank.

APPENDIX B - TABLE LXIV

WELD COUNTY BI-PRODUCTS COMPANY
GREELEY, COLORADO
SAMPLING RESULTS

Seep drain immediately above plant

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Flow MGD
5/25/65	G	1015	13	8.3	12	78	3760	75	19	<0.1	<0.01
5/25/65	G	1315	13	8.2	10	--	3680	179	30	0.5	"

APPENDIX B - TABLE LXV

WELD COUNTY BI-PRODUCTS COMPANY
GREELEY, COLORADO
SAMPLING RESULTS

Seep drain below plant

Dates of Sampling	Type of Sample	Time	Temp °C	pH	BOD mg/1	COD mg/1	Cond. umhos	TSS mg/1	VSS mg/1	Settl. Sol. ml/1	Total Coliform MPN/100ml	Fecal Coliform MPN/100ml	Flow MGD
5/25/65	G	1100	15.0	8.0	9	264	3560	127	50	0.6	--	--	0.02
5/25/65	G	1315	14.5	8.0	12	--	3620	58	39	<0.1	--	--	
6/2/65	G	0920	17.0	8.1	622	556	3600	344	--	0.2	3,300,000	3,300,00	
6/2/65	G	1215	18.0	8.0	--	500	3220	80	80	1.0	4,900,000	3,300	
6/3/65	G	0920	17.0	7.2	610	815	4080	--	--	1.3	13,000,000	4,900	

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Appendix B - Table LXVI

Complete Listing and Description of Industrial Waste Sampling Stations

Remainder of Basin

Station No.	Description	River Mileage
102A	Direct waste flow from Monfort Packing Company plant, Greeley, to Cache la Poudre River	249.0/7.1
102B	Bypass from lift station on Greeley sewer line at 8th Ave., Greeley (predominately Monfort Company wastes) to Cache la Poudre River	249.0/7.2
103B	Greeley No. 3 Canal sampled immediately above Lowell-Paul Dairy waste outfall	249.0/16.8/2.0
103C	Greeley No. 3 Canal sampled below Lowell-Paul Dairy waste outfall	249.0/16.8/2.2
104A	Seep drain sampled immediately above Weld County Bi-Products Company plant, Greeley	249.0/7.3/0.3
104B	Seep drain sampled below Weld County Bi-Products Company plant, Greeley	249.0/7.3/0.2
105A	Drainage ditch sampled immediately above Kuner Empson Company plant, Longmont	270.0/23.0/0.66
105B	Drainage ditch sampled immediately below vibrating screen and above pea vine drainage at Kuner Empson Company plant, Longmont	270.0/23.0/0.54
105C	Drainage ditch sampled below vibrating screen and below pea vine drainage at Kuner Empson Company plant, Longmont	270.0/23.0/0.50
105D	Pea vine drainage at Kuner Empson Company plant, Longmont	270.0/23.0/0.535/0.01
105E	Drainage ditch near mouth below Kuner Empson Company plant, Longmont, to St. Vrain Creek	270.0/23.0/0.4
106	Waste effluent from Carnation Company, Johnstown	260.4/22.3/8.3
107A	Waste discharge from North Plant, Cyclone Filter Division, Gould National Batteries, Inc., Longmont	270.0/23.0/2.2
107B	Waste discharge from South Plant, Cyclone Filter Division, Gould National Batteries, Inc., Longmont	270.0/23.0/2.1

GPO 833-931